

POWER TRANSMISSION DESIGN

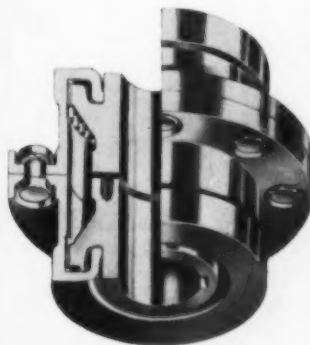
DECEMBER 1961

INCLUDING BEARING DESIGN / APPLICATION

PART 4

Controlling
**TORSIONAL
VIBRATION**

page 24



Get
the
most
out of
gear-tooth
couplings

page 29

*For
extra
life
handle
bearings
with
care*

page 38

your
oil can
with
**CENTRAL
LUBRICATION**

page 19

*The specialized magazine for the power transmission
market—design and application for OEM and in-plant equipment*

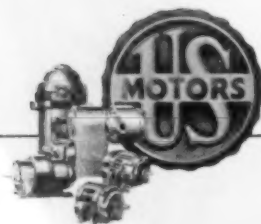
any rpm-*maintained*



...with **U.S. VARIDRIVE'S** new self-locking speed control

Speed setting cannot "drift" or "creep" with new VARIDRIVE control—yet can be easily adjusted to any position at will. Cam and rollers lock mechanism until force is applied to handle, automatically release during speed adjustment. Now set it and forget it, thanks to this plus feature. VARIDRIVES are available from $\frac{1}{4}$ to 100 H. P.

Send for **FREE** Varidrive Color Brochure F-1797.



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Los Angeles 54 (P.O. Box 2058), California—or Milford, Connecticut

Circle 31 on Reader Service Card



like a king of the lanes **maurey drives**

keep power
producing at the
pay-off point

Champion bowlers and Maurey Drives score high the same way . . . they put maximum power at the pay-off point, frame after frame, job after job. Why not lift your daily production average by installing Maurey Drives? It's the proven way to get more power from motor to machine and more profitable operation.

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- Compact Positive Drives . . .
- Variable Speed Drives . . .
- Roller Chain Drives

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Your **maurey** distributor knows power transmission problems. Call him for help and fast delivery.

maurey



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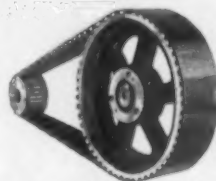
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INCLUDES THE DRIVE
THAT'S RIGHT
FOR YOU



V-Drives
FHP and Multiple



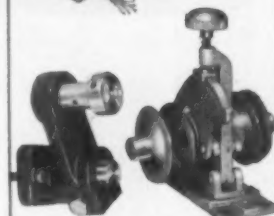
Positive Drives



Super
Wedge Drives



Variable Speed
Drives



hi-g
drive
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Maurematic
Variable Speed
Transmissions



Spring Loaded Pulleys



Sprockets,

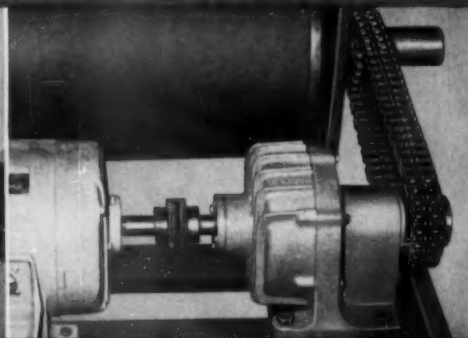
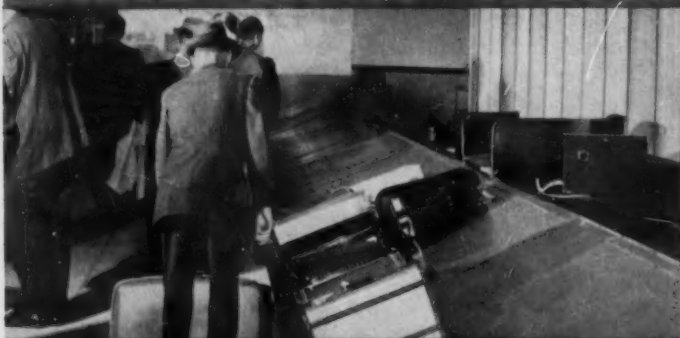


Roller Chains



On UNITED AIR LINES' New Los Angeles Baggage Dispenser...

FRY & CO. PICKS HI-RANGE REDUCTION DRIVE FOR ITS "CUSTOMER ADVANTAGES"



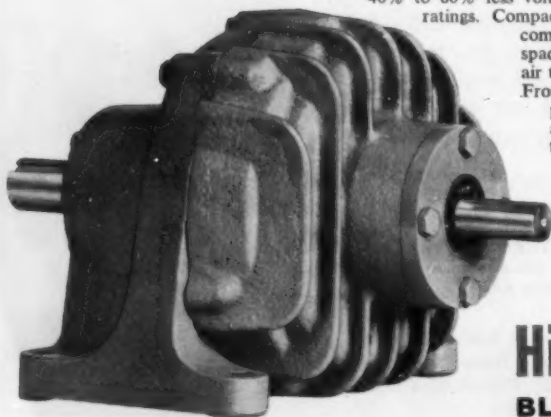
Shipped down by FLOmaster shows compact Hi-Range HR 220 Reduction Drive, 87-1, with 7½ H.P. motor.

"We selected Hi-Range Reduction Drives because they offer our customers low maintenance, economical price and compactness," reports Fry & Co., Inc., Denver, whose FLOmaster automatic self-claim baggage handling equipment is installed for United Air Lines at the new Los Angeles International Airport. There, FLOmaster has two conveyors, 160' and 126' long, both using a Hi-Range Reduction Drive. Fry & Co. has used Hi-Range Drives for over a year—operating in newer air terminals all over the world.

The cycloid principle enables Hi-Range Drives to offer you many unique advantages. Standard ratios of 15-1 up through 174-1 are available IN A SINGLE STAGE OF REDUCTION. Input and output shafts are on the same axis. Units are compact—40% to 60% less volume and weight than other types of reducers of comparable ratings. Compactness of Hi-Range Drives lets Fry & Co. fabricate a more compact conveyor. In fact, use of this unit alone saves enough floor space to accommodate another passenger—an important factor with air terminals!

From a cost standpoint, Hi-Range Drives are equal to or lower in price, when compared to conventional reducers of equal ratio and torque. On this basis, Fry & Co. reports Hi-Range Drives to cost 30% to 50% less. And they're more efficient, particularly in the higher ratios.

Find out how Hi-Range Reduction Drives can save you money...how you can pass the plus-factors of these units on to your customers! Write for New Master Catalog RD-61.



Hi-Range ^{CYCLOIDAL} Reduction Drives

BLACK TOOL, INC. 1924 S. Navajo St. • Denver 23, Colorado

Circle 3 on Reader Service Card

POWER TRANSMISSION DESIGN

POWER TRANSMISSION DESIGN[®]

DECEMBER 1961

volume 3 number 12

THE MAGAZINE OF MACHINE DRIVES

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AUTOMATE YOUR OIL CAN WITH CENTRAL LUBRICATION19

Explains the principal types of central lubrication systems and their functions. Offers selection data and typical application cases.

TORSIONAL VIBRATION—PART 4—CONTROLLING TORSIONAL VIBRATION24

By T. W. Spaetgens

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A 450-hp turbine drive is designed for quick disassembly.

GET THE MOST OUT OF GEAR-TOOTH COUPLINGS29

Why gear-tooth couplings fail; how to prevent failure and increase normal wear-life.

BEARING SECTION

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The right way to handle, mount and remove anti-friction bearings.

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By Henry Lefer

Forged labels have been used to palm off junk bearings on unwary buyers.

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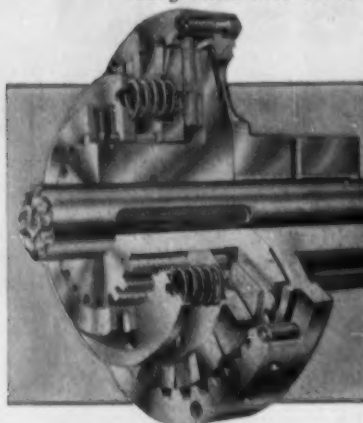
1961 EDITORIAL INDEX55

FACTS AT YOUR FINGERTIPS:

Before going further, tear out a Reader Service Card which you will find bound into this issue. Fill it out as you read and mail it when you're done. We'll act on your request immediately.

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Whatever your driven machine,
you save it from RUIN
every time this clutch cycles...



HILLIARD Adjustable Slip Clutch

- ★ Safely limits torque
- ★ Protects against overload-jams - downtime
- ★ Resumes drive automatically after overload
- ★ Eliminates shear pins and lost time
- ★ Adjustable-while-running feature available

"Value is related to function—not to cost."

Hilliard Slip Clutches give you continuous, positive, and reliable protection of drives on packaging machines... case loaders... conveyors... dishwashing machines... printing presses... circuit breakers... and many others.

They also maintain steady torque while permitting speed variation on fabric drying drums, steel strip slitters and similar equipment.

Adjustable-while-running types maintain constant tension on rewind stands for paper coaters, textile machines, rope, steel and wire mills and for drive systems requiring overload protection but which must be disconnected at times.

Write for Bulletin 300 for complete details.

Remember, HILLIARD is your Industrial Clutch specialist... for more than 55 years... and the line includes Over-Running Clutches, Intermittent Drive Units, Single Revolution Clutches, Hilliard-Twiflex Centrifugal Coupling.

Manufacturing Clutches for over 50 years

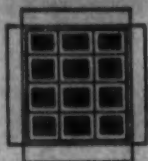
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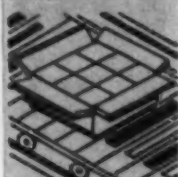
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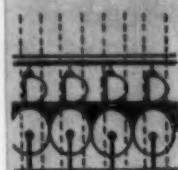
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CONVEYORS



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PRINTING PRESSES

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IPCA

POWER TRANSMISSION DESIGN

SPEED IT UP...SLOW IT DOWN...



ONLY THIS DRIVE IS SIMPLEST, MOST ECONOMICAL ...TROUBLE-FREE

The drum at the top—it could represent one of your machines—changes speed smoothly with each turn of the handwheel. Of at least four ways to do this with simple V-belt drives, only the Worthington Variable Speed Motor Pulley system is so simple, so trouble-free.*

What is so different? In any V-belt system you must, of course, keep the belt perfectly aligned or increased wear will result. The Worthington drive does this perfectly . . . automatically. The illustration shows how.

See how the motor and motor pulley are mounted on Worthington's exclusive Angle-Matic base. The motor travel is at a slight (but precise) angle to the line of the belt. So, as the handwheel is turned, the inner motor pulley flange moves laterally in exact synchronization to its widening gap. And the spring-loaded outer flange stays in perfect alignment, too.

Now compare the Worthington Angle-Matic base and the simple, single-moving-flange Motor Pulley with other systems. One requires a highly complex dual-moving flange pulley. Another requires two adjustable sheaves. A third uses a substitute for the true V-groove companion sheave. None are so simple or trouble-free.

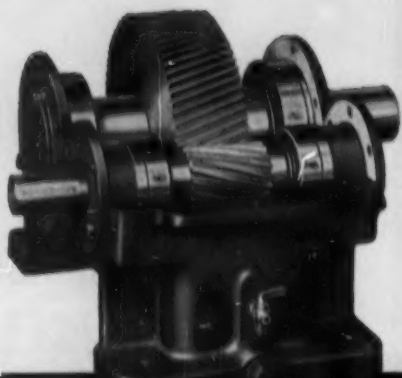
This is just one example of how Worthington gives you more value in variable speed drives. This Motor Pulley produces speed ratios up to 3:1 and is available for $\frac{1}{4}$ th to 15 hp. For more information, please contact your nearest Worthington distributor listed in the Yellow Pages. Or write Worthington Corporation, Section 79-36, Oil City, Pa.

PRODUCTS THAT WORK
FOR YOUR PROFIT



*How does it work? As the handwheel turns one way, it pulls the motor back from the drum; the belt forces itself deeper in the motor pulley; the flanges move apart, effectively reducing the pulley diameter. Because the motor turns at constant speed, the smaller pulley diameter causes the drum to slow down. Turn the handle the other way, the drum speeds up. Up to 3:1 speed change is made by this Worthington drive.

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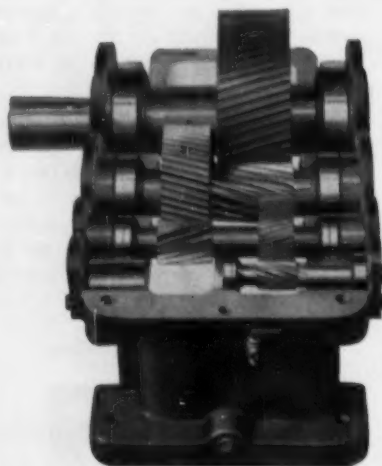
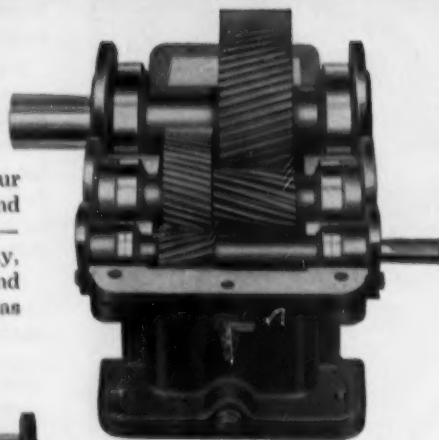
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You get *fast action* when you come to Horsburgh & Scott with your speed reducer and gearing problems.

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Overall design conforms to
AGMA specifications



Write for details on wide size and capacity range of H & S Speed Reducers—Helical, Herringbone, Worm Gear and combinations.



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Specializing in fast production of quality Speed Reducers and Gearing to meet custom requirements.

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LETTERS

Address:
The Editor
Power Transmission Design
812 Huron Road, Cleveland 15, Ohio

What happened to perforations?

I have been reading Power Transmission Design now for some time and feel that it is a good publication in this field. One of the main items that I liked about the magazine was the perforated pages whereby the pages could be easily torn from the magazine and saved for future reference. I noticed that the October issue did not have this feature and believe that you have detracted from your magazine.

It is too bad that you have decided to make this change in the interest of economy.

MARK J. WISE
The Flexicore Co., Inc.
Dayton 1, Ohio

We liked the perforated pages too. On magazines that are held together by staples through the side, the perforated page is most helpful. However, on our magazine with staples through the center, you can remove the page easily and cleanly by tearing along the edge of a ruler.

Universal joint error

I find that your chart tabulating offset in inches vs. angle in degrees ("Why a Universal Joint," Oct 1961, page 22) is in error since the tabulated values are actually based on minutes of a degree and not whole degrees. The chart would be of more value if it were correctly labeled and if it were actually based on degrees.

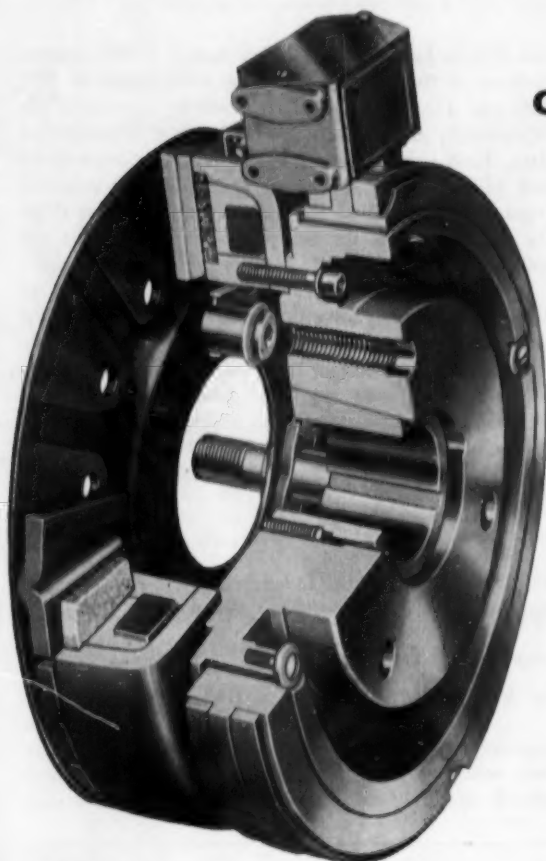
ROBERT J. LE FRANK
H. J. Ruesch Machine Co.
Newark 2, N. J.

You're perfectly correct. The first column in our Table III should read "Angle-min." We hope this error is obvious enough to prevent confusion. Obviously, for an angle of 45 degrees, $d = 70.7$ when $L = 100$.

POWER TRANSMISSION DESIGN

EATON DYNA-TORQ

MAGNETIC-FRICTION CLUTCHES and BRAKES



The Ideal Solution to Exacting Clutching and Braking Problems

These highly responsive, trouble-free units provide accurate control of intricate automatic machinery. Operating on 6, 12, 24 or 90 V.D.C., Dyna-torQ units may be actuated by micro-switches, photo-electric cells, relays or any "ON-OFF" signal to perform a wide range of functions in processing and fabricating applications. The compact rectifier type control converts AC power to DC power and may be remotely mounted out of busy machine areas.

Eaton Dyna-torQ Clutches and Brakes are available from 1 3/4" through 15" in diameter. They may be easily and quickly installed on either new or existing plant equipment. Exclusive features of design and construction mean worthwhile savings.

HP @ 1800 R.P.M. (Typical Application)

MODEL	HP	MODEL	HP
302	1/20	308	7 1/2
303	1/5	310	10
304	1	312	20
305	2	315	25

Dyna-torQ Distributors in many principal cities carry Dyna-torQ Clutches and Brakes in stock for immediate delivery.



ACCURATE POWER CONTROL

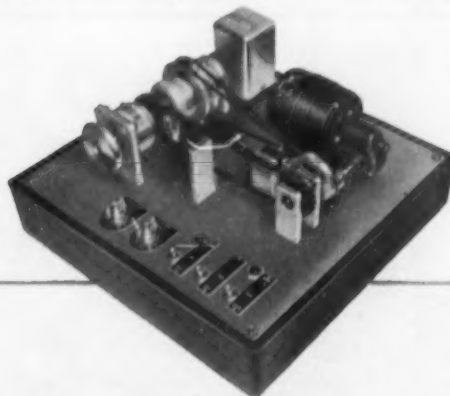
DEPENDABLE MOTION CONTROL

RAPID RESPONSE • LOW MAINTENANCE COST

EASY BUILT-IN INSTALLATION

WIDE RANGE OF SIZES AND CAPACITIES

Send for Illustrated Literature.



Ask your Dyna-torQ Distributor to demonstrate Dyna-torQ in action and see for yourself the many possible applications for Dyna-torQ in Motion Control and Power Transmission.

EATON ——— DYNAMATIC DIVISION ———
MANUFACTURING COMPANY
3122 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

NEWS

FROM THE POWER TRANSMISSION FIELD

New transmission lab cuts field testing by 75%

A recently-built test laboratory for mechanical and hydraulic transmissions and torque converters reduces field testing by up to 75 percent. Prototypes are pretested and the results known in 48 hours. Components are tested



SHATTER-PROOF GLASS protects operator during high-speed tests without obstructing his view.

during manufacture and design changes made without waiting for field reports.

The lab, built by Clark Equipment Co.'s Automo-

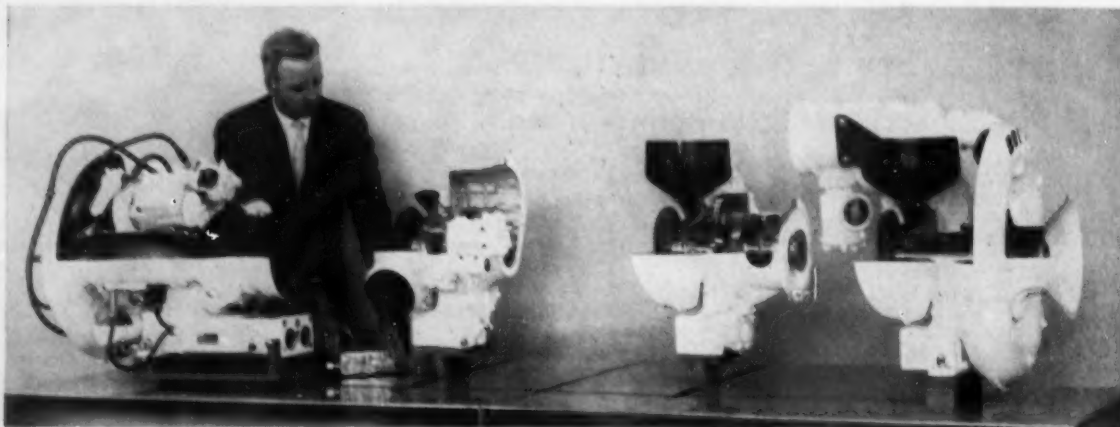
tive Div. in Jackson, Mich., uses mainly dynamometers—three of them in separate test cells, rated at 300, 700 and 1250 hp. These are used to determine life expectancy, shifting quality and other transmission data. Each is mounted on an individually-constructed bed plate, spring supported and vibration-insulated from the floor. Internal combustion engines drive the dynamometers. Control panels are outside the test cells for safety reasons.

A fourth cell has three spinner units rated up to 100 hp. These help solve lubrication problems, test for gear noise and try out speed effects.

The remaining half of the 9500-sq ft of floor space is a tear-down area for test vehicles, which include highway trucks, construction equipment, fork lift trucks, tractors and others. Clark said its previous testing facilities were not adequate to increase production.

1962 SAE Show—over 300 firms to have displays

The SAE-sponsored Automotive Engineering Congress and Exposition (Cobo Hall, Jan. 8-12) is already clocking up some impressive statistics. Over 70 percent of the space has been sold; 60 percent of the 1961 participants have signed up for 1962; and the exposition area has



WORKING TURBINE EXHIBIT shows how a single power or gas producing section can be mated with various output sections. The three cutaway sections to the left, each driven by an electric motor, move on tracks. The section at right is fixed. The sections in various combinations form three separate engines. From left to right: Boeing 502 gas producer; next, the

T50, 270-hp helicopter engine; output section of the 502-10MA, 330-hp engine; and output section of the 502-128 ground support compressor. The two center sections move out separately to mate with the gas producer, which moves to meet them. The gas producer moves the length of the display to join the fixed compressor. Photo, The Boeing Co.

1 HIGH-SPEED OPERATION

Balanced release levers permit high-speed drives. Lever "throwout" is eliminated for longer bearing life. Patented anti-friction rollers give instant release with minimum pedal pressure.

2 ACCURATE FIT

Close-tolerance drive between cover and pressure plate assures smooth starts. Highly accurate bolt circle fits flat flywheels—accurate outside pilot diameter fits counterbored flywheels.

3 VIBRATION DAMPENER

Coil-spring vibration dampener absorbs vibrations between engine and transmission. Noise, rattle and thrash in the gear train are eliminated for smooth, quiet clutch operation.

ROCKFORD SPRING-LOADED CLUTCH



International model C-130 Dump Truck equipped with Rockford Spring-Loaded Clutch



4 HIGH-TORQUE DESIGN

Powerful engagement springs, properly spaced over the facing area, assure maximum driving contact. Compact, low-inertia design prevents gear clashing and delayed shifting.

5 SMOOTH ENGAGEMENTS

Dynamic and static balancing assures you of smooth, enduring clutch performance. Both driving and driven members are balanced to eliminate vibration.

6 HIGH-TEST FACINGS

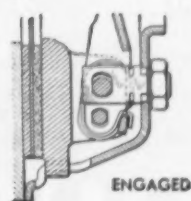
Using only the highest quality facings, Rockford Clutches give extra-long clutch life, provide cushioned starts, reduce scoring and greatly cut costs of downtime replacement and labor.

7 PERFECT ALIGNMENT

Close-tolerance splined hub assures perfect disc alignment. Through-hardened hub gives long life. Precision manufacturing and rigid quality control eliminate chances for misalignment.

7 Good Reasons Why Idea-Men Count on Rockford Reliability

Above are seven reasons why more and more design men specify Rockford Spring-Loaded Clutches. Equally important, ROCKFORD RELIABILITY is due to 63 years of creative engineering, precision manufacturing and rigid quality control. Rockford offers complete design engineering service at no cost or obligation. You're backed by a worldwide service network. Write today for complete details on ROCKFORD RELIABILITY.



ROCKFORD CLUTCH

1227 WINDSOR ROAD, ROCKFORD, ILLINOIS

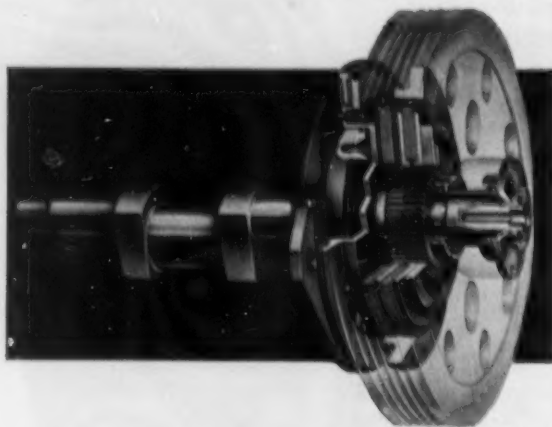
Export Sales Borg-Warner International • 36 So. Wabash, Chicago, Ill.

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OF
BORG-
WARNER

To Increase Press Efficiency



MINSTER Clutches for Press Conversions

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- eliminate downtime caused by clutch failure
- reduce maintenance and parts replacement
- increase die life
- reduce operator fatigue
- improve safety and increase production

Minster conversion units, made by a press manufacturer who knows your problems, are standard clutches individually applied to your press. Complete with flywheel and shaft, ready to drop into place. Thousands in daily use.

Write for Clutch Conversion Booklet CC57

THE MINSTER MACHINE COMPANY • MINSTER, OHIO

MINSTER®

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NEWS

jumped from 50,000 sq ft in 1961 to 200,000 sq ft. in 1962.

There will be over 80 technical sessions, with over 200 papers, including one on exotic powerplants for tomorrow's vehicles, and another on new techniques of magnetic forming. An unusual part of the program will be the Pan American Day, scheduled for January 11. Leading engineers from Mexico, Argentina and Brazil will read papers on solving automotive engineering problems in those countries. Dr. Keith T. Glennan, president of Case Institute of Technology and former NASA administrator will report on his study of South American engineering education.

Fuel-cell cars will have high performance

Cars with fuel-cell dc-motor-drive systems will accelerate faster and maintain high speeds with less energy than internal-combustion types.

These are the conclusions made by A. F. Erwin and W. W. Edens of Allis Chalmers Mfg. Co. in a recent talk on fuel cell developments.

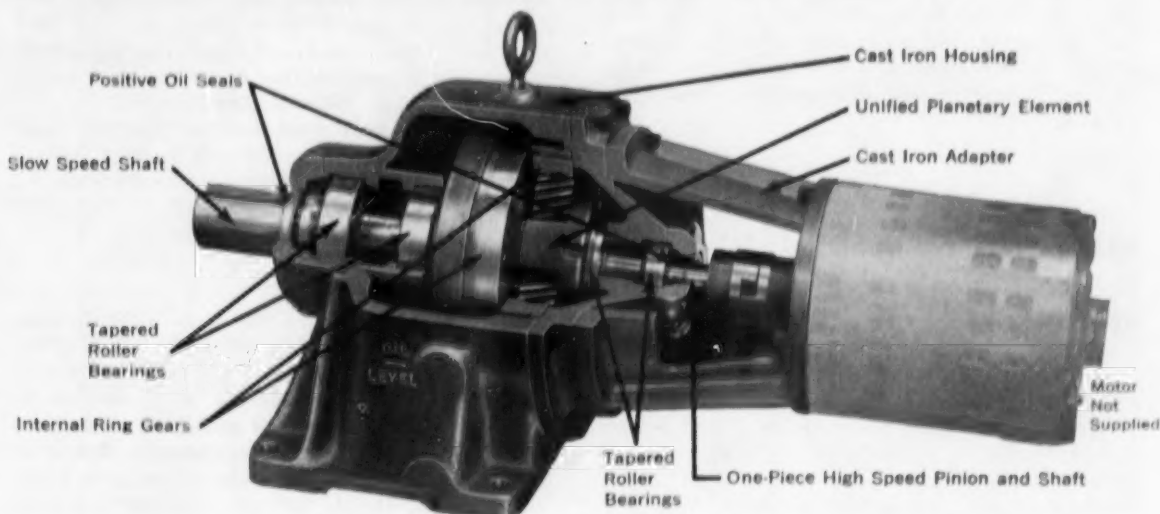
Comparing the fuel-cell-dc-motor drive with the internal-combustion engine they found that the latter has a low overload or low maximum torque capability. It therefore needs high-rated horsepower to supply the torque for rapid acceleration. Also, engine accessories such as generator, pump, fan, and torque converters use a disproportionate amount of power at high engine speeds. And a final disadvantage is the peaking out of the gasoline engine efficiency



DIESEL-ENGINE TRACKMOBILE, a utility rail and road vehicle made by the Whiting Corp., has rubber-tired road wheels which are hydraulically raised and lowered to convert from rail to road travel. Trackmobiles are able to pull heavily loaded rail cars into a blind stop, then by lowering the road wheels, roll across the tracks to the next job. This one is working for one of the major oil companies in Texas.

Engineering Data

HORIZONTAL MOTORIZED DIFFERENTIAL SPEED REDUCERS



CAST IRON HOUSING—designed for high heat radiation. One-piece construction, close-grained gray iron for maximum strength and rigidity.

UNIFIED PLANETARY ELEMENT—integral primary and secondary planetary gears, mounted in a ductile iron cage—for even wear, equalized load, smooth operation. Hardened and ground, alloy steel gears carry entire power transmission load.

CAST IRON ADAPTER—permits use of any standard "C" flange motor. Flexible coupling (optional) connects motor to input shaft which can be driven in either direction.

INTERNAL RING GEARS—primary and secondary. Cut from alloy steel, heat treated for wear resistance.

ONE-PIECE HIGH SPEED PINION AND SHAFT—machined from

alloy steel with teeth cut integral with the shaft. Hardened and accurately ground to close limits.

SLOW SPEED SHAFT—heat treated, precisely ground alloy steel. Low speed gear web of ductile iron.

TAPERED ROLLER BEARINGS—opposed pairs support the radial load, take thrust, ensure permanent alignment of both input and output shafts.

POSITIVE OIL SEALS—chevron type, keep oil in, dirt out. Oil and heat resistant, non-abrasive, low coefficient of friction.

AVAILABLE in any ratio from 1.1:1 to 50,000:1 without increasing the number of parts. Each model has a range of reduction ratios. Overall dimensions of individual models do not change regardless of ratio.

- 7 Models
- .12 to 81.51 H.P.
- Ratios 1.1:1 to 50,000:1
- Max. Output Torque
50 to 113,000 in. lbs.

Series HM Horizontal Motorized Speed Reducers are a part of the Winsmith Planetary Differential Reducer line. They feature cut-tooth helical gears of 15° helix angle for smooth, positive power transmission—greater load carrying capacity—larger reduction ratios in smaller, more compact units—minimum wear and long service life. Winsmith Horizontal Motorized Differential Reducers are easy and convenient to install, require no bedplate, deliver more horsepower per pound of weight and cubic foot of space, and permit easier integration with the driven machine.

Write today for complete information or call your nearest Winsmith Representative listed in the Yellow Pages. He is a technically trained expert who is always ready to help you with any speed reducer problem. For both standard and special power transmission applications, you'll find it pays to standardize on Winsmith.

WINSMITH, INC.

204 Eaton Street, Springville, (Erie County), New York



• • • Winsmith Speed Reducers are made by American craftsmen to meet American design and production standards.

Circle 33 on Reader Service Card

December, 1961

NEWS

curve near maximum hp at high speeds. This means that its efficiency suffers at lower power and lower rpm. For instance, a 4000-lb automobile needs only 80 hp to travel at 85 mph.

In contrast, the fuel cell has no parasitic accessories, and a great overload capability for short-term power demands, coupled with the high starting torque of the dc motor. Maximum torque capability of a gasoline engine may reach 30 percent above rated torque. A dc motor can provide over 250 percent of rated torque for the time needed to accelerate a vehicle.

NLGI elects Johnson president; nine new Board members

C. L. Johnson was elected 29th president of the National Lubricating Grease Institute at NLGI's annual meeting in Houston. Johnson

is the president of Jesco Lubricants and was previously secretary and vice president of the Institute.

T. F. Shaffer, of the Shell Oil Co., is the new vice president, and W. A. Magie, president of Magie Brothers Oil Co., is the new secretary. Nine new directors were elected to the Institute's 21-man board.

Predicts research to cost nearly \$16 billion in 1962

Research spending in the U. S. will run up to almost \$16 billion in the coming year. This estimate comes from Battelle Institute economist George W. James in the forecasting session of the Annual Meeting of the National Association of Business Economists.

Dr. James predicted the government would spend about \$10 billion for research next year, in stepped-up space and defense programs; industry about \$5.5 billion, an increase of \$600 million over the 1961 estimate; and universities and foundations about \$350 million. By comparison, the figure for 1960 totaled \$14 billion, and for 1950 only \$3 billion.

"If research were considered an industry," said James, "its total 'sales' would rank it about midway among the 20 major industries in the United States."

Gates to build new plant in Belgium

Three more Gates Rubber Co. officials have left for Belgium where the company is building a \$4 million V-belts and hose plant.

The three are: Hubert Harris, managing director of the new plant; George Stark, who will be plant superintendent, and Donald Gebhard, the factory's technical superintendent.

RCA Selects **Simplatrol** Electric Clutch Brake

CONSISTENCY — SMOOTHNESS — QUIETNESS

These are the reasons that R. C. A. engineers gave for selecting a Simplatrol CB-62 electric clutch-brake unit for use in its new electro-mechanical printer.

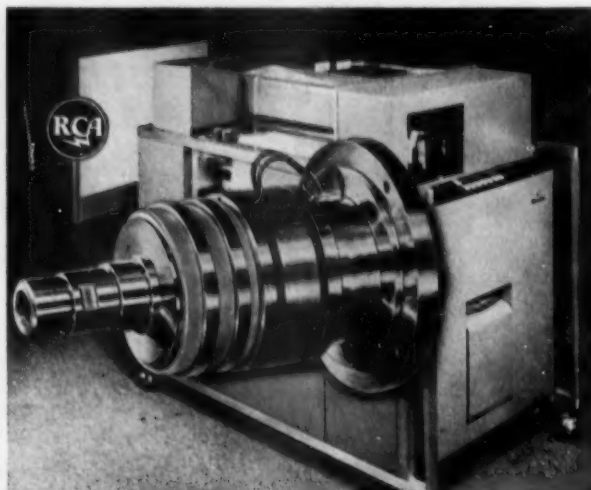
In this high speed application, the Simplatrol unit feeds the paper — and indexes it accurately for printing. Specially developed in cooperation with R. C. A. engineers, the Simplatrol unit gives "remarkable consistency".

In the tape drive section of the unit, the Simplatrol clutch-brake delivers a smoothness and quietness not previously available, and so necessary in business machines.

The Simplatrol Diaphragm makes the Difference!

The only moving part in the Simplatrol clutch and brake operation is the patented diaphragm. Simplicity is the keynote and the basis of the success of these performance-proved clutches and brakes.

Ask for Simplatrol literature on miniature and small, fixed field and larger sizes electric clutches and brakes. Ask also for data on adaptation of Simplatrol clutches and brakes to your special requirements.



R.C.A. 801 Data Processing System — Electro-mechanical Printer

Simplatrol products corp.

24 SALISBURY ST., WORCESTER, MASS.
Representation in Key Industrial Areas

Circle 24 on Reader Service Card

MEETINGS

JANUARY

8-12 **Society of Automotive Engineers**, 1962 Automotive Engineering Congress and Exposition, Cobo Hall, Detroit.

9-11 **Institute of Radio Engineers**, 8th national symposium, Statler Hilton Hotel, Washington.

22-24 **Institute of Aerospace Sciences**, Thirteenth Annual Meeting, Hotel Astor, New York City.

22-25 **National Plant Engineering & Maintenance Show**, Convention Hall, Philadelphia.

24-26 **American Society of Mechanical Engineers**, Heat Transfer Div., Second Symposium on Thermophysical Properties, Princeton, N. J.

Jan. 28-Feb. 2 **American Institute of Electrical Engineers**, winter meeting, Statler-Hilton Hotel, New York.

Jan. 29-Feb. 1 **American Society of Heating, Refrigerating and Air-Conditioning Engineers**, semiannual meeting, Chase-Park Plaza Hotel, St. Louis.

Jan. 30-Feb. 2 **Society of Plastic Engineers Inc.**, annual technical conference, Penn-Sheraton Hotel, Pittsburgh.

Jan. 30-Feb. 3 **American Society for Testing Materials**, annual meeting, Chalfonte-Haddon Hall, Atlantic City.

FEBRUARY

6-8 **Society of Plastics Industry, Inc.**, 17th reinforced plastics division conference, Edgewater Beach Hotel, Chicago.

MARCH

4-8 **American Society of Mechanical Engineers**, gas turbine process industries, Shamrock Hilton Hotel, Houston.

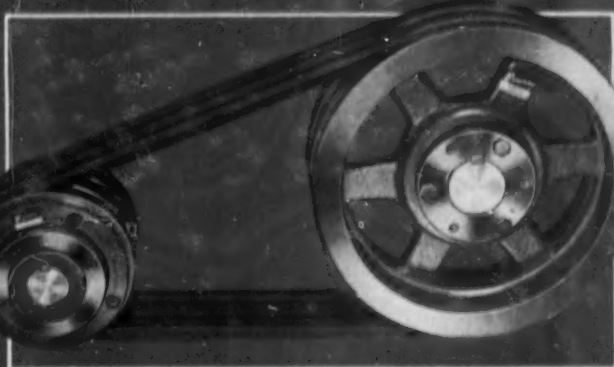
APRIL

30-May 3 **Design Engineering Show**, annual exhibit, McCormick Place, Lakefront Exposition Center, Chicago.

Browning MVP

MULTIPLE GROOVE

VARIABLE SPEED DRIVES...



WIDE APPLICATION at LOW COST



For reliable and convenient speed variations in drives up to 125 hp, investigate Browning's new MVP line. Consider these many advantages:

- ★ 360° adjustment
- ★ patented locking ring assembly—will not work loose
- ★ concentric grooves — all MVP sheaves are finish-grooved after assembly, providing excellent concentricity and uniform pitch diameters, insuring a true running sheave
- ★ permanently balanced. Flanges do not rotate in adjustment
- ★ easy to adjust—simply unlock two locking screws, turn the locking ring, relock
- ★ ground barrels for precision fit
- ★ precision bored center flanges for close fit, no chatter
- ★ adjusting rings of malleable
- ★ infinite speed adjustment
- ★ same split taper bushing that is used in the entire Browning line; also fixed bore types

Your Browning Distributor can give you complete details, and new catalog MVP-101. Or write Browning Manufacturing Company, Maysville, Kentucky.

Browning...OUR 75th YEAR

POWER TRANSMISSION EQUIPMENT

POWER TRANSMISSION DESIGN

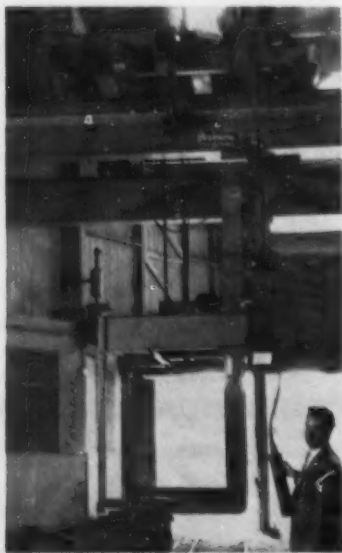
AT WORK

New twist for the forklift



TOOTHED BELT DRIVE for forklift crane is reliable and economical.

A simple innovation by John T. Hepburn Co., Toronto, Canada, has turned an overhead crane



CONTROLLED by an operator on the ground, the lift can accurately position 7½ tons of girders.

into a forklift. The crane's forklift arrangement, powered by a ½-hp electric motor, is built onto the lower extremity of the traveling hoist. Its forks can be swung outwards to parallel each other, by a double bevel-gear drive. With the forks out "flat," the crane is moved up close to the steel beams to be moved, and the forks are swung under them. The 7½-ton crane then carries them easily to their new location, and places them by reversing the procedure. All operations are controlled from the ground.

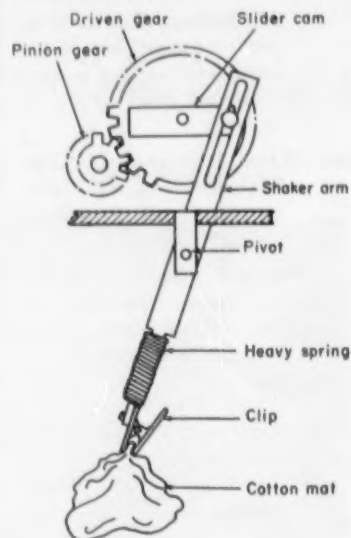
Power for the fork swivel arrangement is transmitted to the bevel gear-shaft through a toothed belt. Archibald Couper, Materials Handling Div. engineer for the Company, says the toothed belt was selected partly for economy, and partly to keep the noise down.

Another interesting point in the crane design, is the way in which electrical power is transmitted to

the traveling hoist-motor. Sliding contacts are mounted under the flange of the crane's cross-member I-beam. Here, they are safe from the maintenance crew's boots, and protected from dirt and dust.

Slider cam whips shaker arm

Engineers at the American Gas Association Laboratories in Cleveland developed a device that makes lint. They need the lint to test pilot lights on such gas appliances as furnaces and hot-water heaters. These pilot lights should resist clogging by lint.



The device has a shaker arm with a mat of cotton linters attached to its lower end. A slider cam mounted on a driven gear whips the shaker arm back and forth. This frees long fibers from the mat. Air conveys these fibers into the pilot test chamber.

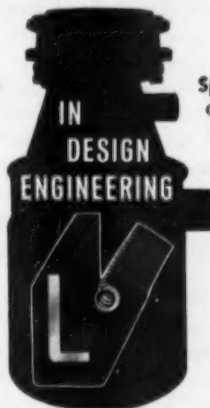
Long fibers are needed—they cannot be bought. So, the engi-



OIL SEALS

"Garlock KLOZURE Oil Seals have proven consistently satisfactory in sealing motor shafts." W. T. Hedlund Manufacturing Company makes this report after specifying the seals to protect bearings and keep water from the motor of their Whirl-A-Way Food Waste Disposers. Hedlund finds other advantages of KLOZURE Oil Seals, too—less downtime, longer life, easier to install—and adds finally that "... leaky units have become negligible."

Take a tip from Hedlund. Design with Garlock KLOZURE Oil Seals. Where bearings need the best protection . . . on pumps and motors, on power shovels and lift trucks, in steel mills . . . KLOZURE Oil Seals prevent leakage of lubrication, seal out foreign matter. KLOZURE Oil Seals are oil and grease resistant, impervious to mild acids and alkalies, non-abrasive, and will withstand temperatures from -40°F to $+250^{\circ}\text{F}$.



As a shaft seal for their Whirl-A-Way Disposer Units, W. T. Hedlund Manufacturing Co. selects Garlock KLOZURE Oil Seal Model 92 with rubber-covered metal case and stainless steel garter spring.

Special seals are available for service against harsh corrosives at temperatures to $+500^{\circ}\text{F}$. If you have a particular sealing problem, get in touch with your local Garlock representative. He can furnish you with complete design and application information. Why not call him at the nearest of the 26 Garlock sales offices and warehouses throughout the U. S. and Canada. Or, write for Catalog AD-181. Garlock Inc., Palmyra, N.Y.

Canadian Div.: Garlock of Canada Ltd.

Plastics Div.: United States Gasket Company

Order from the complete line of quality Garlock products—Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.



GARLOCK



GET FAST CLUTCH REBUILD SERVICE

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Significant Savings—Your Formsprag Clutch has 3 lives . . . it is designed to be rebuilt for unimpaired performance.

Rapid Turnaround—When you return a Formsprag Clutch for service, it normally comes back in "virtually new" condition in 5 to 10 working days.

Fewer "Spares"—Whether rebuilt or brand new your Formsprag Clutch will work more efficiently, more economically, with fewer service shutdowns.

Write for Catalog 105B.



**FORMSPRAG
COMPANY**
23587 HOOVER ROAD, DEPT. 123
WARREN (DETROIT), MICHIGAN

Precision Power Transmission Products
Circle 8 on Reader Service Card

AT WORK

neers produce them from the mat during each pilot test.

Power source for the drive is a 1/15-hp motor. Reduction ratio between the pinion and driven gears is 6 to 1.

Couplings eliminate bearing failures

Some direct-coupled pumps broke down about once a month, far too often to suit the Electromanganese Div. of Foote Mineral Co., Knoxville, Tenn. The engineers traced the cause to misalignment, which made the bearings fail. So, they decided to try flexible couplings to compensate for the misalignment. Result—no more breakdowns from misalignment. The flexible couplings have performed well for two years.



RUBBER SLEEVE absorbs misalignment and free-end float.

The company uses 150 pumps with capacities of 40 to 250 gal/min to transfer manganese solutions. Motors are from 3 to 30 hp, 1150 to 3600 rpm. The corrosive solutions wore down metal parts and mounts, causing the misalignment. Then, pump and motor bearings failed. The flexible couplings were able to stop the damage to the bearing.

Each coupling consists of two cast flanges and a flexible-rubber sleeve. Sleeve teeth lock into flange teeth. No clamps or screws are necessary.

The couplings absorb shock and vibration. They can overcome angular misalignment up to 1 deg, parallel misalignment up to 1/16 in., and free end float up to 1/8 in.

Couplings made by T. B. Wood's Sons Co., Chambersburg, Pa.

Continued on page 17

Large



- FURNISHED COMPLETE
- CUSTOM CUT FROM YOUR BLANKS
- HEAT-TREATED, CASE OR FLAME-HARDENED

SIMONDS GEAR produces a complete line of industrial cut gears in a full range of sizes from cast or forged steel, gray iron, bronze, Meehanite, rawhide or bakelite. Also heat-treated, case or flame-hardened carbon or alloy steel. Or, you may have your own gear blanks custom cut to your order. Same quality . . . same prompt service. Send us your requirements for quotation.

ALSO stock carrying distributors of Ramsey Silent Chain Drives and Couplings; and industrial V-belts.



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WORMS • WORM GEARS
RACKS
PINIONS



**THE
SIMONDS
GEAR & MFG. CO.**

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QUALITY GEARS FOR SEVENTY YEARS

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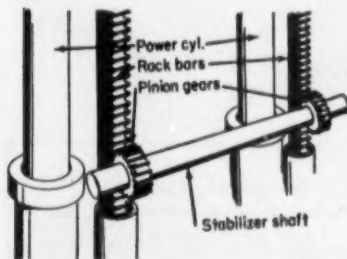
POWER TRANSMISSION DESIGN

AT WORK

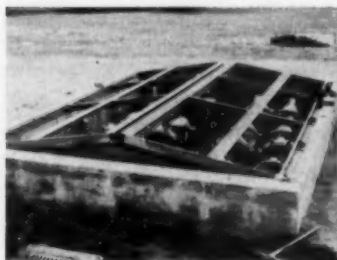
Rack-and-pinion opens floodlight vaults

Four batteries of floodlights bathe the Washington monument at night with dramatic effect. An unusual application of a rack-and-pinion controls each installation.

A steel vault houses each battery of lights. Huge swinging doors on top of the vault open the same way as sidewalk elevator doors. Two oil-hydraulic cylinders open and close the doors. Globe Hoist Co. makes these cylinders which have a 3500-lb capacity and a 6½-ft rise. To assure level opening, a rack-and-pinion synchronizes the motion of the cylinders.

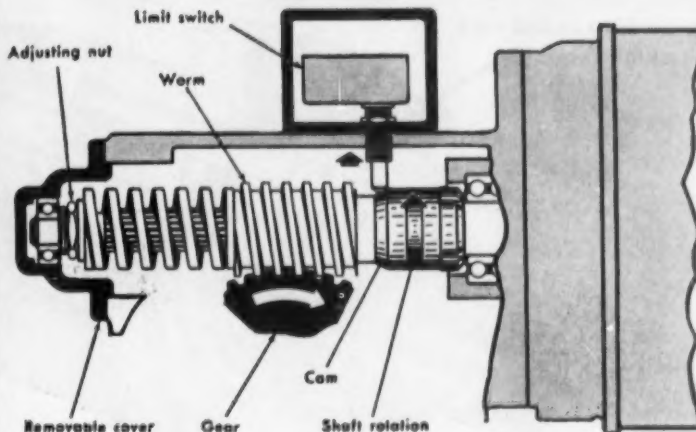


● **Rack-and-pinion**—A stabilizer shaft with pinions at each end links the power cylinders. The pinions engage rock bars. The upper ends of the racks are attached to the swing platform. The lower ends telescope into pipes alongside the cylinders. The rack-and-pinion compensates for any load shift on the platform. It keeps the surface level at all times.



● **Operation**—At night, a workman turns a key in the vault switch. The cylinders push open the doors and the floodlights bathe the monument. At dawn, a flip of the switch retracts the cylinders and closes the heavy doors.

NOW POSITIVE PROTECTION for MOTORS and MACHINERY



As long as applied torque is within pre-determined limit, spring bears against end of worm and holds it centered on gear. Excessive torque causes worm to move axially along splined motor shaft, compressing spring and bringing cam surface in contact with limit switch which cuts power, stopping motor.

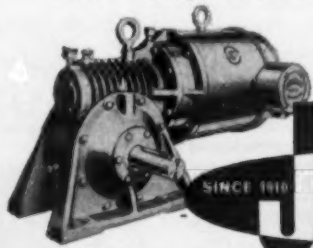
...JANETTE Adjustable Torque Overload Cutout

Here's *dependable* protection for drive units, driven mechanisms, personnel, and work in progress . . . and a sure-fire way to reduce down-time.

Janette Adjustable Torque Overload Cutout is far more sensitive than conventional shear pins, or friction clutches and similar devices. Its sliding worm on a spline shaft (described above) assures shutdown of the driving motor within closely controlled torque overload limits. Unit is easily reset when cause of overload is removed.

Color-coded, interchangeable springs permit selection of a wide range of torque limits. Each spring has a simple linear adjustment over its own range. Protect *your* equipment and avoid costly downtime the *positive* way . . . with Janette Adjustable Torque Overload Cutout.

Write today for Bulletin 5-7.



SINCE 1916

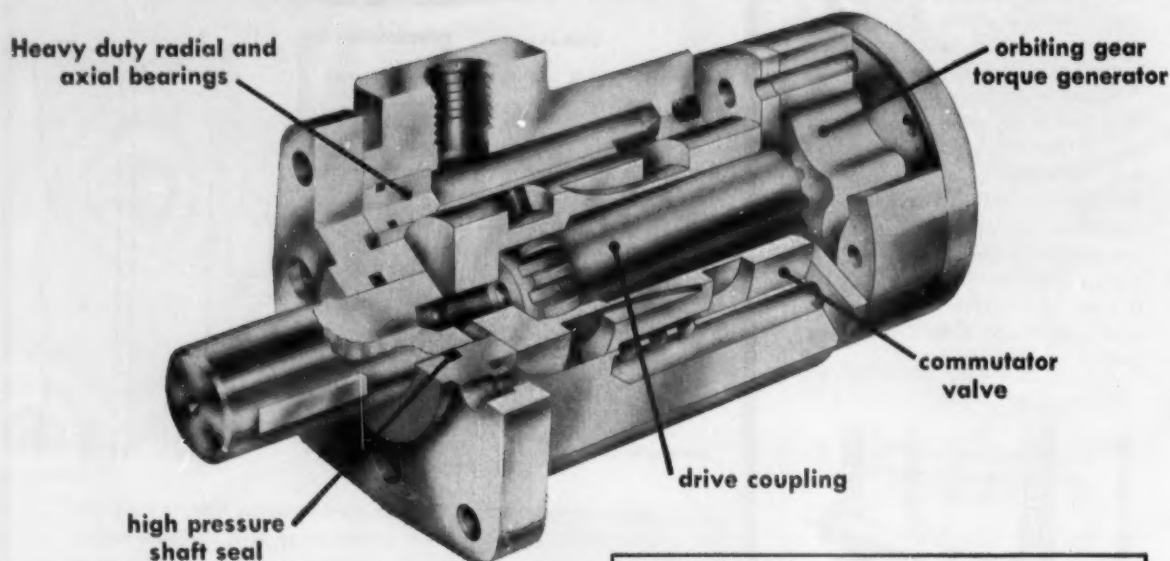
Janette

GEAR MOTORS
MOTORS
SPEED REDUCERS

Division of Holtzer Cabot Corporation • Boston 19, Mass.

Circle 14 on Reader Service Card

New Hydraulic Motor Design Provides High Torque at Low Speeds



ORBIT MOTORS®

DELIVER MORE TORQUE PER LB
and AT LESS COST

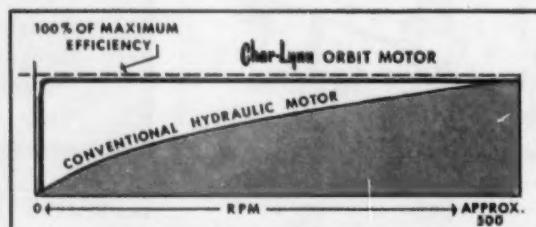
The Orbit principal utilizes an internal gear mechanism to act both as a fluid displacement motor and a gear reducer. The outer segment is a stationary part of the motor housing and has internal gear teeth which mesh with corresponding teeth on a smaller gear or rotor which rolls inside the outer gear, turning about an eccentric axis in an ORBIT.

The rotor gear rolls through six complete orbits during each single rotation of the output shaft. Thus an effective speed reduction of 6-to-1 is obtained. The use of seven fluid chambers with the inherent 6-to-1 ratio provides 42 fluid power cycles per shaft rotation, a distinct advantage in obtaining smooth rotation.

As it rotates, the rotor gear causes a continuous opening and closing of the spaces between the teeth. Half of these spaces are subjected to fluid pressure and the opposed half is connected to the return section of the motor.

The rotary commutator valve distributes the fluid so that the pressured space rotates in phase with the rotor gear, thus causing continuous rotation. Motion of the rotor gear is transmitted to the output shaft by a coupling which has crowned involute splines to match the bores of the output shaft and the rotor gear.

The high pressure shaft allows ORBIT MOTORS to be operated "in series" without external drain lines.



High efficiency over complete operational range

- Speeds from 0 to 800 rpm
- Torques to 3300 inch lbs.
- Starting torque substantially equal to running torque
- Full reversible—instant starting, stopping
- Only 3 moving parts
- 4 types of mountings available
- 3 port sizes, 7 power element selections
- Compact, light weight
- Eliminates costly and complicated power transmissions
- High volumetric and overall efficiency

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Char-Lynn

HYDRAULIC HORSEPOWER
PRODUCTS

POWER TRANSMISSION DESIGN

DECEMBER 1961

GET SET TO LUBRICATE AUTOMATICALLY

1 Standardize on lubricants . . .

A certain amount of effort on the part of the maintenance department can undoubtedly reduce the number of lubricants needed in your plant. Five or six specifications are almost always sufficient for one plant.

2

Standardize Grease Fittings . . .

By reducing the number of types of grease fittings, you'll be able to cut down the number of grease applicators, you'll also be able to cut down the number of application devices you need.

3

Standardize the Type of Application Device . . .

Choose only application devices that keep the lubricant free from dirt and contamination. Hand guns should be filled from portable filler pumps, and these should be filled from power-operated transfer pumps.

4

Set Up a Central Lubricating System . . .

All the preceding steps have depended on the human element—the oiler. An automatic lubricator provides the right lubricant at the right place at the right time. Start with one machine, or bank of machines. Fit the lubricator circuit to a hand pump. When the whole plant has been converted, replace all hand pumps with a central pumping system.

Automate your oil can with CENTRAL LUBRICATION

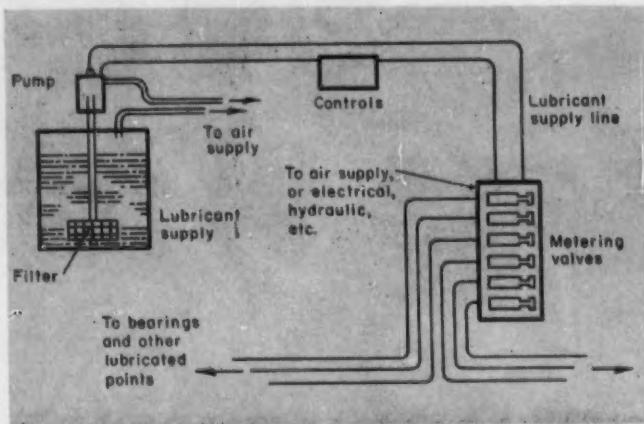
IT ALL STARTED with James Watt, and nowadays its almost impossible to get anywhere without lubrication. When industry was young, no doubt, it was all right to pump oil into every bearing (or steam slide valve, or what have you) with an oil can. But as industry grew more and more competitive, and machinery ran faster and faster, and as oil became more and more of an expense . . . and finally, as labor costs went up and up . . . engineers were asked to find more efficient ways of lubricating machinery.

The first attempts—oil or grease cups—permitted the operator to pour oil directly into a container which in turn fed it to the bearing at a slow, constant, rate. Well, nearly so. When the cup was full, oil fed rapidly into the bearing, and as the cup emptied, the supply rate diminished. Still, until about 1930, this system was the best available.

What central lubrication does

The modern lubricating system is designed to:

- Supply lubricant accurately
- Provide it at regular intervals.
- Feed lubricant to diverse locations of a machine, from an accessible central location
- Lubricate automatically
- Lubricate without waste, or loss of lubricant
- Show amount of lubricant being supplied, and signal any system failure or malfunction.



A PUMP delivers lubricant to the battery of measuring valves. Sometimes the oil passes through an atomizer first, if the system is a mist-oil type. The valves are arranged to supply the required amount to each bearing. Controls can be as simple as an on-off switch, or may cause lubrication of each bearing point separately at set times.

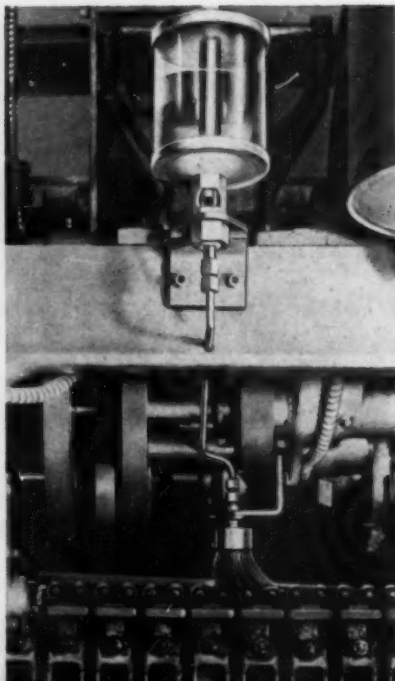


HAND-GREASING a grinding machine may take 5 min., four times a day. Multiply this time by say, 200 machines, and quickly figure the costs. Then assume the whole shop can be lubricated with an entirely automatic system, probably for about \$20,000. Courtesy, Fafnir Bearing Co.



ROLLER CHAINS will perform far better, and longer, with proper lubrication. Too little will cause binding, and eventual seizure, or stretching. Too much can collect dust and dirt that will gall and maybe cause the chain to seize. Courtesy, Clark Equipment Co.

ONE SURE WAY of providing the right amount is by using an automatic lubricator. Oil runs through the brush, and is carried to every bearing in the chain by a fine brush. Courtesy, Oil-Rite Corp.



It may not do all of these things, since costs vary with the type of plant or machine being serviced, and the methods of doing the job vary quite considerably.

Metering systems

Oil can be metered to the point of application in any of three ways:

- Orifice
- Mist
- Piston displacement

Grease, because of its viscosity, can only be distributed by piston displacement.

In the orifice system, a header line is run from the pump. Branch lines run from there to orifices at every bearing. Orifices are available in a variety of sizes, to accommodate the flow requirements. Flow, of course, depends on orifice diameter, oil viscosity, and pressure.

Mist lubrication disburses micron-sized particles to the bearings through very low pressure air lines. At the bearing surfaces, the particles are combined into larger particles by reclassification fittings, and blown onto the bearing surfaces. Metering devices control the amount of lubricant to each bearing by controlling the velocity of the mist as it passes through the orifices. If the mist passes out slowly (at less than about 3000 ft per min), it does not wet the bearing surface. Raising its velocity above this limit causes lubricant to be deposited.

Piston-displacement methods of lubricating whole areas can be subdivided into three types:

- Single header system
- Double header system
- Series system

The single header . . . or single line system, uses spring force to prime the injector pumps. Spring-loaded injectors are mounted in the header line. The pump delivers lubricant to the header line until all the injectors have delivered their measured quantity of lubricant. This relieves the pressure in the header line so that the spring can force the pistons back, thus

priming the injectors for their next stroke.

The double header . . . or double line header system, uses hydraulic pressure both to feed lubricant and to prime for the succeeding stroke. A four-way valve alternatively applies and relieves pressure on each of the two headers.

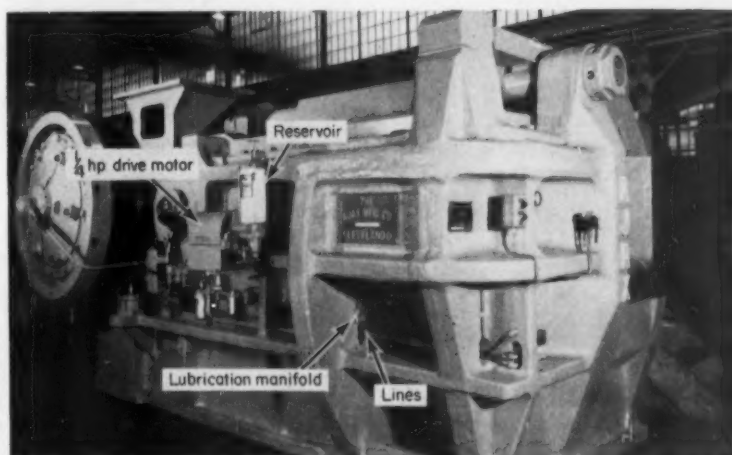
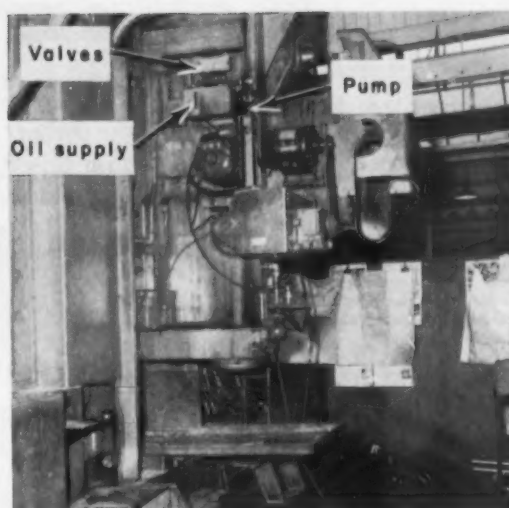
In the series system . . . individual feeders are manifolded to form a feeder block. As lubricant is pumped into the feeder inlet, each piston moves in turn to deliver lubricant to the bearings. Each piston completes its stroke before the next piston moves. This action is like that in an engine—each piston fires in sequence, and their firing rate depends on the rate at which fuel is fed to the carburetor. In the series lubricating system, speed depends on the lubricant's rate of feed to the manifold.

Which is best? When a blockage or malfunction occurs in any part of the series system, the whole lubricating operation halts. If a similar blockage occurs in either of the other piston displacement methods, lubricant continues to flow to all bearings except the one at the end of the blocked line. This difference has been the cause of an industry-wide controversy . . . which system is best? Some argue that a lubricating system should halt if one bearing fails to receive lubricant . . . others maintain that it's easier to lubricate one bearing manually than to close the whole operation. In fact, there are probably cases in favor of each argument. Bear this difference in mind when selecting a plant lubricating system.

Warning devices are essential . . . Central lubricating systems should always include warning devices. Sometimes only one such device is necessary for the whole plant, sometimes a separate one is needed for separate areas. Warning may take the form of a visual signal; noise, such as a buzzer or siren, or the signal can be used to stop the drive motor, or disconnect a clutch.

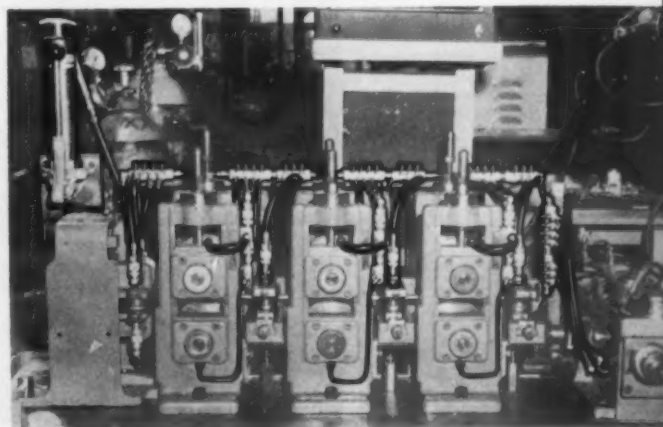
Some warning systems will warn of low oil pressure, and changes in

DUPLICATE FORMING MACHINE has an electric-motor operated pressure lubricating system for supplying oil to the spindle-head gears and bearings. The machine forms three landing gear shafts simultaneously. Courtesy Cleveland Pneumatic Industries.

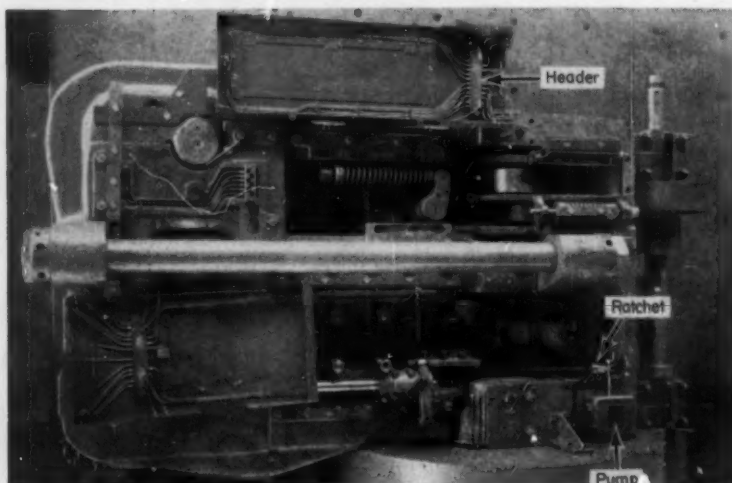
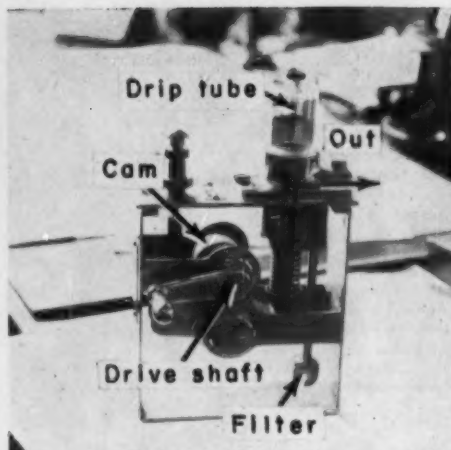


HIGH-PRESSURE lubricating system (to 3000 psi) for a 4-in. forging machine. Anti-friction bearings and a few sealed bearings are not served by the system. A $\frac{1}{4}$ hp electric motor pumps the oil and light grease. It delivers from zero to 1 cu in. per min, at time intervals set for any particular job. Courtesy, Ajax Mfg. Co.

OVER SIXTY BEARINGS are lubricated on this heli-arc welding and forming mill. A single pull on the lever (left) delivers grease through the single-header, pneumatically-powered system. Courtesy, Yoder Co.



ECCENTRIC ROLLER CAM raises and lowers the plunger arm to pump fluid through the drip tube. Plunger stroke can be adjusted from zero to 100 percent of capacity by a simple screw. On the downstroke, the pump draws a measured quantity from the reservoir. On the upstroke, lubricant is forced to the point of lubrication. Courtesy, Houdaille Industries.



GRAVITY FEED system on forging machine. Cam on crankshaft controls ratchet-arm motion. As crankshaft turns, ratchet arm drives pump which delivers preset amount of lubricant to two lube headers. From the headers, the lubricant goes to the lines that carry it to the components requiring lubrication. Photograph was taken from above. Courtesy, Ajax Mfg. Co.

TEN TRUNNION BEARINGS must be continuously lubricated on this bark-ing drum, at the Oxford Paper Co.



flow rate, changes in temperature, or of viscosity. Others merely report zero lubricant flow.

Advances in feed-speed devices

Early central lubricating systems had no means of measuring how much lubricant was supplied to each bearing. The need for measuring techniques quickly showed up, and resulted in the "sight feed tube." This is still useful for gravity or low-pressure systems. It consists of a glass tube beyond the metering pump, through which the lubricant drips. It gave rise to the present-day measuring term "drops per min."

However, when high pressure lube systems were developed, the sight feed tube had to be modified. It was merely moved to the suction (or low pressure) side of the metering pump.

METHODS OF VALVE OPERATION

1. Manual

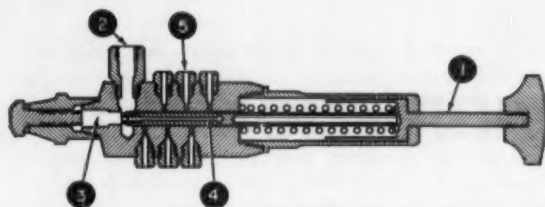
Where neither compressed air nor vacuum is available, a manually-operated, push type pump handle is used. Ideal for quick installation on farm implements, tractors and light production machinery. One stroke of the pump handle lubricates each bearing while equipment is operating, or idle.

2. Air

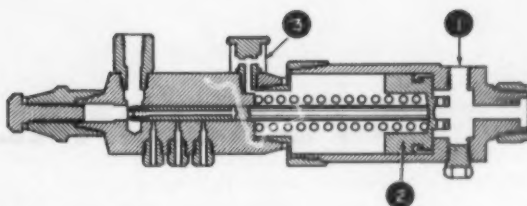
For use where compressed air is available, on truck trailers and buses, automated lathes and packaging machinery. System may be actuated automatically at pre-set intervals with an adjusted cycle timing device, or manually, as with each application of air brakes. Minimum air pressure 50 psi.

3. Vacuum

For applications where vacuum is available. For light trucks, automobiles, fork-lift trucks. System may be actuated with every brake application, or manually, at the operator's discretion. On passenger cars, a push button and signal light are located on instrument panel. Pressing the button admits vacuum

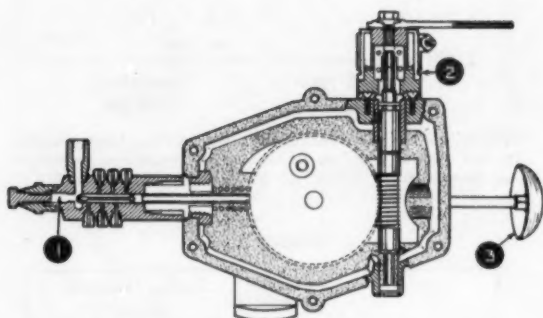
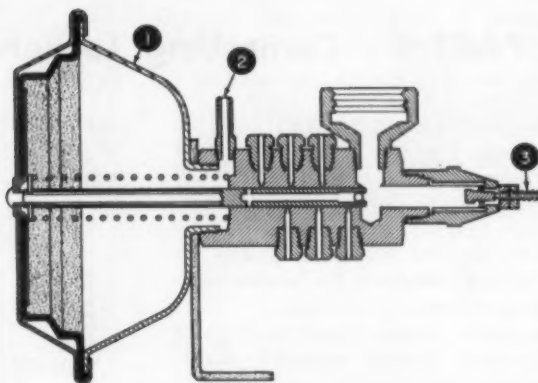


MANUAL 1. pump handle and piston
2. lubricant inlet
3. measuring chamber
4. outlet passage
5. outlet ports

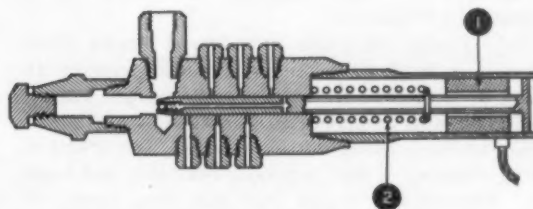


AIR 1. air inlet
2. air piston
3. filter

VACUUM
1. vacuum diaphragm
2. vacuum inlet
3. electric contact assembly



MECHANICAL 1. measuring chamber
2. clutch
3. indicator knob



ELECTRICAL 1. electrical assembly
2. spring return

to actuate the system. Signal light indicates completion of the lubrication cycle. Minimum vacuum of 17 in. mercury is required.

4. Mechanical

Ratchet system harnesses reciprocating or rotary motion for positive displacement lubrication. For light machine tools with power for the necessary reciprocating or rotary motion needed to operate the ratchet. As little as 0.52 in.

straight-line motion will drive the worm gear that cycles lubricant through the bearings.

One ratchet system will feed 12 lubrication points. It is possible to mount two units on a 15-bearing machine so that one will deliver oil and the other grease.

5. Electrical

For use with large, stationary machinery, electrical systems generally are solenoid-operated. The

advantages over other methods are: few moving parts; high operating force available.

Acknowledgements

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Wm. W. Nugent & Co., Inc., Skokie, Illinois.

TORSIONAL VIBRATION

By T. W. Spaetgens, P. E., Consulting Vibration Engineer, Toronto and Vancouver, Canada

PART 4—Controlling Torsional Vibration

IN MOST POWER TRANSMISSION SYSTEMS torsional vibration is natural. However it can be reduced so as to cause no damage. One way to control torsional vibration is simply to dispose fatigue-producing critical speeds properly with respect to operating speeds. This requires tuning the system by adjusting either the WR^2 values of the masses or K values of the shafting, or both.

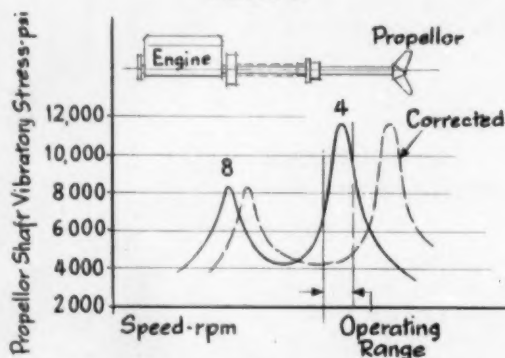
The marine propulsion system shown in Fig. 12 suffered from frequent broken propeller shafts, coupling bolts, accessory drive chains, and propeller blades, and from overheated bearings. A moderate amount of retuning moved a 4th order critical upward about 100 rpm and eliminated the troubles. Retuning meant increasing the intermediate shaft diameter by 30 percent.

The torsional vibrations of a geared marine diesel drive in a work boat required drastic retuning to make it workable. The entire speed range was so congested with engine-excited critical zones that minor retuning would not have helped. But a helical spring coupling of high torsional flexibility and large WR^2 , between the engine and gear box, tuned all important critical zones down below the minimum (idling) operating speed. This ended annoying bearing failures, broken teeth, clutch failures, and hull vibration.

In some cases it is desirable to tune to higher frequencies (Fig. 12) and in other cases to lower frequencies (Fig. 13). In place of the flexible coupling in the diesel drive a quill shaft of equal torsional stiffness could have been used had there been room. Quill shafts occasionally require an overload limiting device due to the high stresses involved in pass-

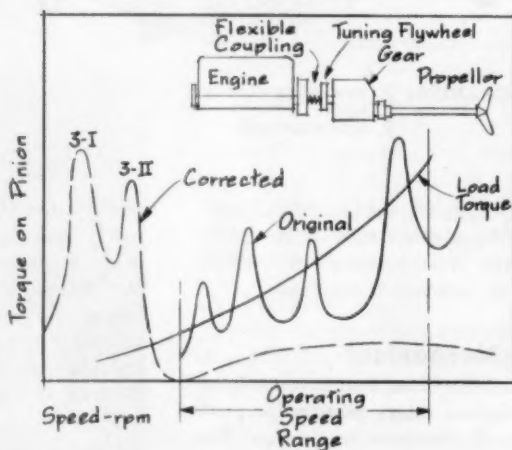
age through criticals, such as the 3rd order criticals of Fig. 13. Alternatively, damping may keep the transient criticals under control.

FIGURE 12



RETUNING can often reduce damage resulting from a badly situated critical zone, as in the marine propulsion transmission described.

FIGURE 13



FOR THIS MARINE GEARED propulsion system, the torsional problem was too involved to permit an easy solution. A very flexible coupling proved to be the simplest way out.

TORSIONAL VIBRATION—Reprints

This 4-part article is now available as a reprint. The article is subdivided as follows

- Part 1—Fundamentals, glossary of terms
- Part 2—Multimass systems
- Part 3—Gearing
- Part 4—Controlling torsional vibration.

Prices for the complete reprint: 1-9 copies 75c each; 10-19, 50c each; over 50, 30c each. Write to: Reprints, POWER TRANSMISSION DESIGN 812 Huron Rd., Cleveland 12, Ohio.

Flexible couplings which employ nonlinear flexible elements have varying stiffness characteristics, depending on load. Their vibratory deflections (which involve variable coupling loading) therefore produce a constantly varying natural frequency of the system. So resonance is not continuous and apparent damping is introduced. These damping qualities may be important in the control of torsional vibration. The advantages of this type of coupling have to be weighed against the time needed to analytically evaluate their effects with speed and load changes.

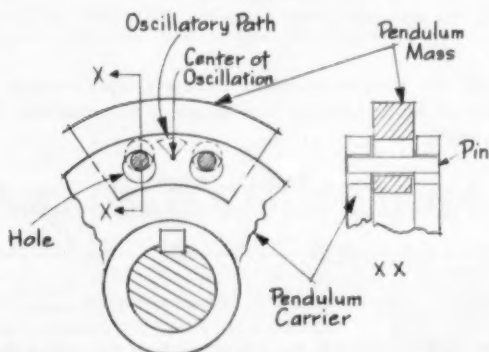
The **rotating pendulum detuner** is the most interesting torsional vibration control device. A pair—or several pairs—of opposite rotating masses are supported by pins. They are free to oscillate in over-sized holes and act as a positive or negative WR^2 or flywheel effect (a single mass would introduce vibratory forces). Thus it can tune a system to a higher or a lower frequency. It can also act as an infinite flywheel, divorcing one part of

a system from another as far as vibration is concerned. Further, it can be made to limit torsional amplitudes by its inherent non-linearity effect. Pendulum detuner design is very involved and its use is generally confined to repeatable applications.

A famous hydroplane power plant uses a pendulum detuner to shift criticals out of the racing range. Two severe critical speeds fell in the lower and upper racing range of the boat (below, left). The pendulum was designed with positive inertia for the lower critical, and negative inertia for the higher critical. This lowered the natural torsional frequency for one harmonic and raised it for the other, and entirely cleared the speed range of criticals. Breakdowns ceased and the racing speed range was extended.

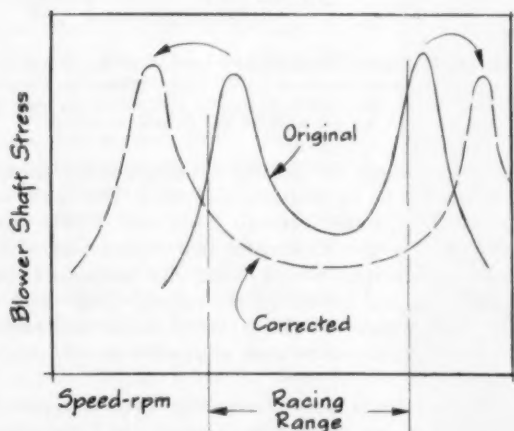
Rubber and silicone viscous dampers are most widely used. They dissipate vibrational energy in relative movement between the two elements of the damper. The rubber damper has a stiffness factor—the rubber itself—so it is actually a tuned device. The tuning is not very acute, and can be affected

FIGURE 14



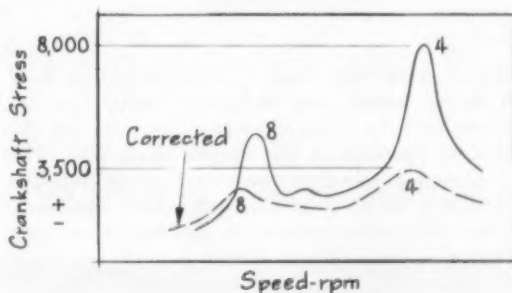
THE BIFILAR PENDULUM DETUNER can be designed to act as a positive or negative flywheel to eliminate torsional vibration, but it is expensive.

FIGURE 15



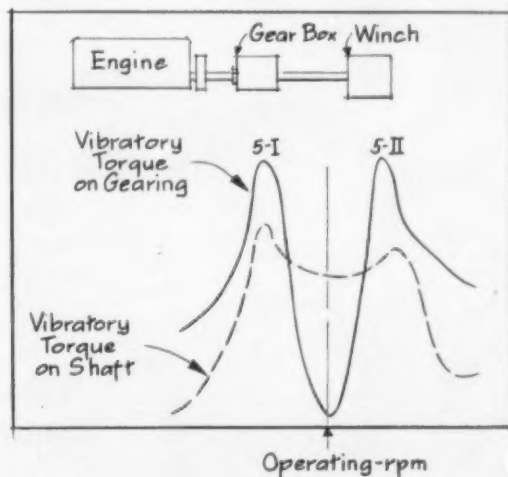
AN EXAMPLE of the type of solution achieved with the detuner is this hydroplane powerplant.

FIGURE 16



A MOTOR-COMPRESSOR SET was redesigned, using a viscous damper.

FIGURE 17



CANCELING THE EFFECTS of a dangerous vibration on one critical component sometimes increases the vibration on other, more rugged components. This has been done with this marine winch, that had been troubled with severe shaft vibration.

TORSIONAL VIBRATION

by changes in the natural frequency of the system it protects, as well as by changes in its own natural frequency. It must therefore be tailored to each application. Viscous dampers do not have stiffness factors (they are untuned), so one damper may suit a variety of systems.

The undamped and damped characteristics of an electric motor-compressor set are shown in Fig. 16. A viscous damper on the motor output coupling reduced the maximum vibratory stresses in the compressor crankshaft from ± 8000 psi to ± 3500 psi in the operating range.

One unusual method of controlling constant speed systems uses the opposing effects of two vibrations

to cancel the vibratory effects on one critical component of a system. It does this at the expense of augmenting the vibration on more rugged components. This is analogous to the vibration absorber in linear vibration. The vibratory torque on the gearing shown (due to a major order of excitation) is virtually zero due to mode-cancellation. Vibratory torque on the drive shaft is shown dotted.

Other means of controlling torsional vibration are fluid couplings, constant-velocity joints, friction and displacement hydraulic dampers, magnetic clutches, controlled-torque clutches, proper selection of engine firing orders, V-angles and throw arrangement. Each method must be selected on the basis of suitability to the individual case.

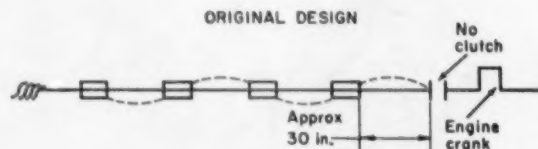
BEARINGS CAN DAMP VIBRATIONS

It wasn't until they built the prototype of their 12-ft power pruner that McCulloch Corp, Los Angeles, realized the value of proper placement for the supporting bearings in the flexible shaft tube. The original design called on these bearings to hold the flexible shaft in its flexible housing with maximum rigidity. They were supposed to prevent the rotating shaft from wearing the tube away.

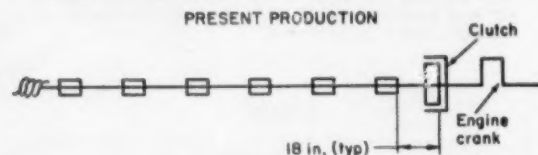
But, definitely, the prototype was not the smooth-operating device it was supposed to be. It chattered.



And the housing vibrated intensely, and became too hot to hold. Cutting bits broke with annoying frequency.



AT 30-IN. SPACING, the critical speeds of the original design are between 5000 and 8000 rpm.

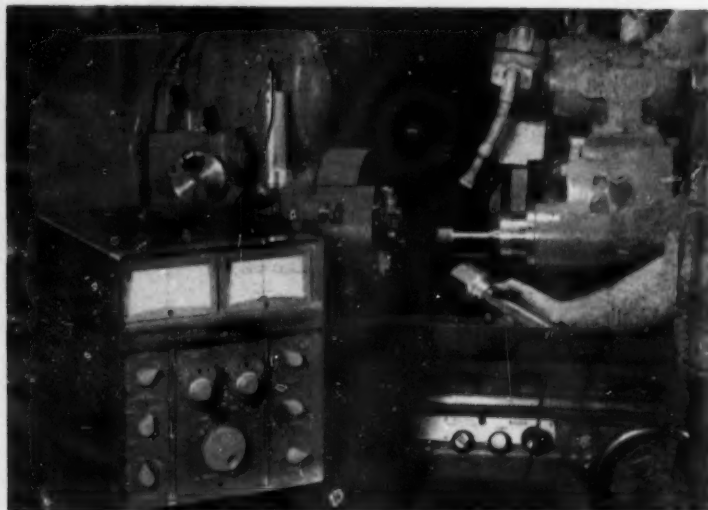


PRESENT PRODUCTION SHAFT with 18 in. bearing spacing has critical speeds between 13,000 and 20,000 rpm. The centrifugal clutch was added to isolate the driveshaft from the crankshaft, and cut out a lot of the general vibrations.

Tests without the flexible housing quickly showed the trouble to be torsional vibration. The shaft was intended to rotate between 2500 and 12,000 rpm. McCulloch engineers decided that replacement of the support bearings would solve the problem. They calculated, and tested, all the natural frequencies of the shaft within the design speed range, and placed the bearings at—or as near as possible to—the major nodes.

Bearing loads and its resulting heat disappeared. There were no more bits shattered, and the noise-level dropped. As shown by McCulloch's experience, the original purpose of the bearings became secondary to their new function as a damping medium.

USE AN ANALYZER TO CHECK FOR VIBRATION



VIBRATION ANALYZER includes a stroboscopic light and a velocity pickup. It costs under \$2000. Courtesy, RayData Corp.

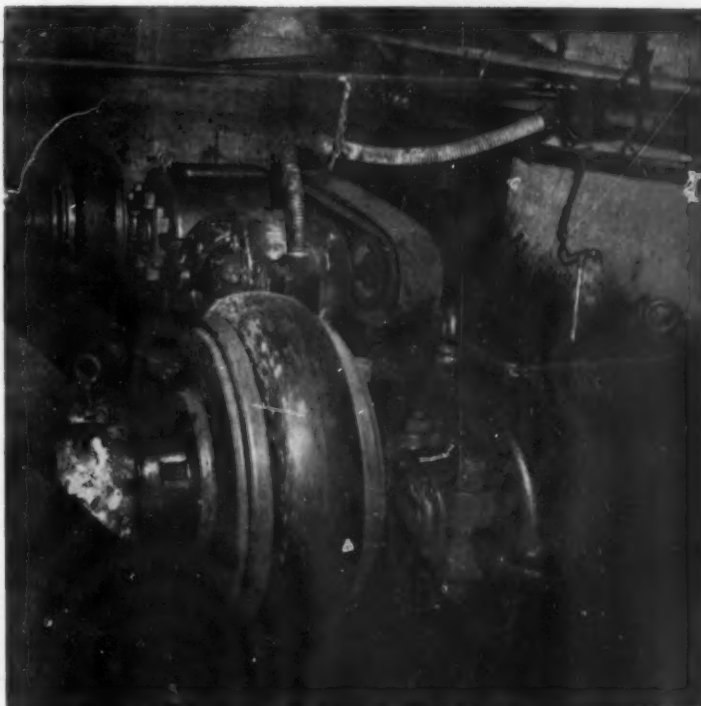
When drive components fail without apparently being overloaded or badly treated, vibration is a most likely suspect. Although the critical speeds can easily be calculated for simple, cantilevered rotating masses, the work involved becomes enormous for more complex systems. It is often easier to build a prototype, and test for critical condition especially if the design is of a one-of-a-kind component. The portable signal analyzer shown is completely transistorized, for low power consumption. It can be operated from a battery pack, or from 110 vac. It will measure vibration amplitudes from 5 to 100 millinches, at from 3 to 10,000 cycles per sec. Its accuracy, 2 percent, is sufficient for most design purposes. It can also be used for examining discrete frequencies within the total spectrum when they may be causing damage to secondary components. An operator can produce usable figures from the tester after a few minutes of instruction.

FLEXIBLE COUPLINGS ABSORB VIBRATIONS

Cookers at Modesto Tallow Works, Modesto, Calif., are driven by 30-hp electric motors through floor-mounted speed reducers. They turn the mixer shafts at 38 rpm.

Shock loads were severe enough to break the driveshaft under overloads. Guntert & Zimmerman, Stockton, Calif., distributors of power transmission products, were called in, in an effort to solve the problem.

They recommended two 24-in. diameter rubber tire-type flexible couplings. After they were installed, between reducer and mixer shafts on two cookers, maintenance costs were reduced because the couplings have no moving parts or friction surfaces. They don't require periodic inspection or lubrication, and they compensate automatically for shaft misalignment and end-float. Further, they protect the cookers from practically all shock loading. When the flexible element has to be replaced, it can be done simply and quickly without removing flanges from the shafts or changing the position of the motor or driven machine.



BIG FLEXIBLE-ELEMENT COUPLING between the source of vibration and the machinery to be protected solves the problem for Modesto Tallow Works. Courtesy, Dodge Mfg. Co.

Easier maintenance for a crushing mill

IN DESIGNING a sugar-cane crushing mill drive, engineers took pains to minimize downtime for maintenance and overhaul. The drive can be readily disassembled without tearing down the entire machine.

The mill has three rolls 7-ft long with 3-ft diameters. A gear at one end of the top roll meshes with similar gears at the corresponding end of each bottom roll. Power supplied to the top roll is transmitted through gears to the bottom rolls. During crushing, the gears turn the rolls at $4\frac{1}{2}$ to 5 rpm.

Two hydraulic rams apply 650-tons force to the top roll to assure constant force between top and bottom rolls. The top roll "floats" between the hydraulic pressure and the cane being crushed. After the cane passes between the top and bottom-front rolls, a turnplate scraper routes it to the interface of the top and bottom-rear rolls. It takes only minutes to remove the turnplate for inspection or replacement.

To remove a hydraulic ram for servicing it is necessary only to twist the ram cartridge assembly. This frees the lock. Then, a crane lifts it out of its socket. A spare assembly can be installed in minutes. This permits servicing the replaced cartridge while the mill continues to operate.

Tapered link keys keep the upper housings for the rolls in place. Workmen disengage these keys to remove the housings. The rollers then can be inspected or removed with a crane.

A 450-hp, 4500-rpm, steam turbine supplies power for the mill. A heavy gear reducer provides required roll speed. Power flows from the final reduction through a flexible coupling to the mill. A typical low-speed gear for the reducer has a 12-ft diameter and a 2-ft face.

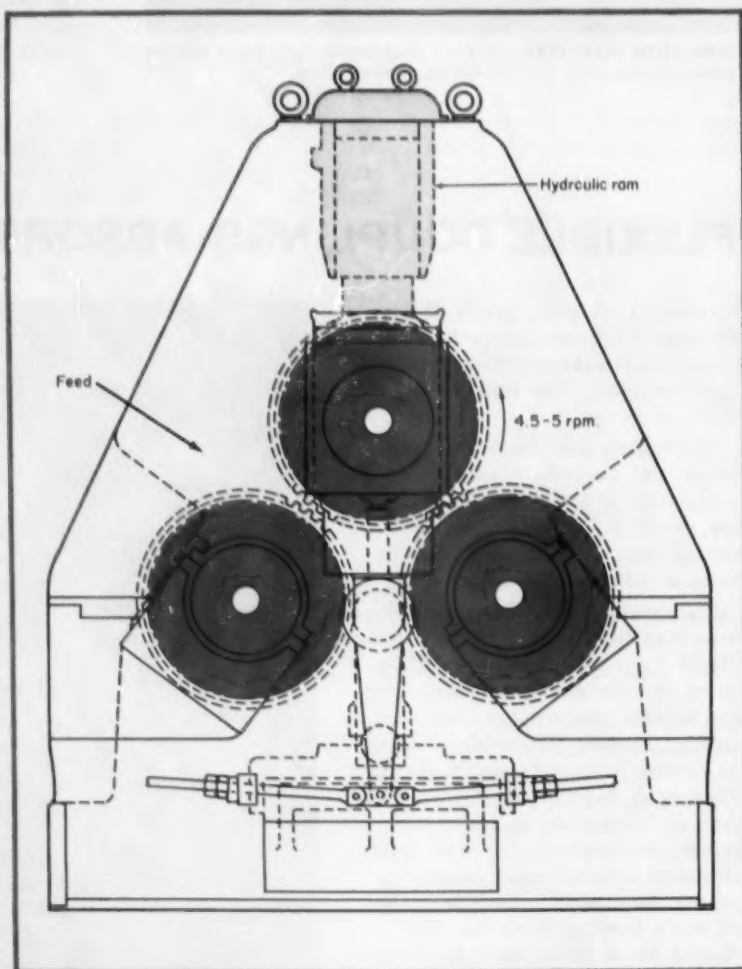
Made by the Squier Corp., Div. of Buffalo Forge Co., Buffalo, N. Y.



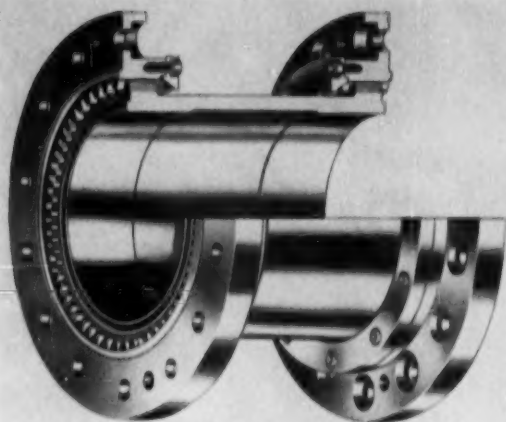
HYDRAULIC RAM is removed by twisting it to unlock, then lifting it out of its socket.



BOTTOM ROLL is removed by lifting it in direction of arrow and sliding it out of the socket.



END VIEW of crushing mill. Hydraulic rams at each end of top roll exert 650-tons force to assure constant force between top and bottom rolls.



DOUBLE-ENGAGEMENT SLEEVE COUPLING. Sleeves with internal teeth are bolted to the shaft flanges. A flanged or hubbed spool piece with teeth cut on the periphery connects the shafts. Courtesy Koppers Co., Inc.

Get the most out of GEAR-TOOTH COUPLINGS

By MILTON S. BERG, Consulting Engineer, Washington, D. C.

GEAR-TOOTH COUPLINGS come in two types: hub and sleeve. Hub couplings are for shafts without flanges. Sleeve couplings require flanged shafts. Both come in single-engagement and double-engagement designs, the commonest being the double-engagement hub coupling.

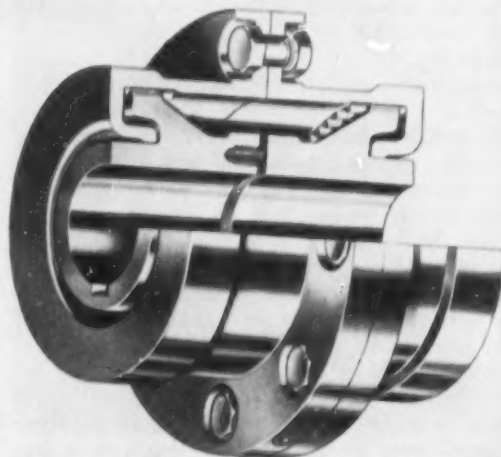
Removing couplings

Take care not to damage the coupling or machine. Put penetrating oil on coupling bolts and nuts if they are rusty or covered by hard-packed dirt.

Mark the position of hub and sleeve teeth. This makes it easy to mesh the same teeth when the

Gear-tooth couplings will last for many years if they get proper maintenance. Maintenance is also the key to efficient operation.

DOUBLE-ENGAGEMENT HUB COUPLING. Hubs have external teeth cut on the periphery. They mount on the shafts of the driving and driven machines. A sleeve with internal teeth connects the two hubs. Courtesy Koppers Co., Inc.



coupling is reinstalled. To separate the sleeves of a hub coupling, use forcing bolts in tapped holes. Always use two forcing bolts. Take them up alternately, little by little, to avoid distortion and damage.

Push the coupling sleeves back when removing hubs. Always use a puller to remove hubs. Using a torch to expand a hub for removal may draw the temper of the steel and distort it. Sometimes it's desirable to wire the sleeve to the hub after sliding the sleeve back. This makes the coupling easier to handle.

It's necessary only to remove bolts to detach sleeve couplings. Many of these couplings use fitted bolts

GEAR TOOTH COUPLINGS

that may require forcing to remove. A C-clamp and short drift will do the job.

Installing couplings

For hub couplings, make sure that flange faces of the sleeves are clean and free of burrs. Put a heavy coat of grease on the teeth of grease-lubricated couplings. Slide sleeves on the shafts. Make sure that oil seals and snap rings are installed. Then, wipe the shafts with an oily rag. This prevents rust that might make future hub removal very difficult. Force the hubs on the shafts with keys installed. If expansion of the hubs is necessary, heat them in a 300 F oven or in 300 F oil.

Follow the manufacturer's instructions for proper shaft separation. Tighten hub set-screws if they are used. If hubs and sleeves have match marks, line up the marks. Install a new gasket for mating sleeves. For grease-lubricated couplings, cover the hub teeth with grease before sliding the sleeve forward. Bolt up the flanges. Add lubricant and replace the lubricant-hole plug.

Certain oil plugs have a gasket. If this gasket is cracked or stretched, replace it. Some grease-lubricated couplings can be filled by a grease gun after the coupling is assembled. If there is a relief plug, remove it before filling. *Replace lubricant and plug.*

Sleeve couplings generally use fitted bolts to secure the sleeve to the flange. Use fitted bolts for replacements if the original bolts were fitted. Use weight-matched bolts to avoid unbalance.

To make sure that the sleeve runs true with its flange, measure the periphery with a dial indicator. Before bolting, clean the flange and sleeve, and remove burrs.

Inspect spray fittings to assure clear openings. Then, examine oil spray for correct positioning.

Always install a guard around any exposed coupling. Use sheet metal or wire mesh fine enough to prevent fingers going through. The guard should extend up to adjacent bearing housings. If the guard is light sheet metal or wire, use heavy stiffeners at the ends and horizontal joint.

Replace or repair any coupling which has "seized." It can cause shaft breakage and damage to radical and thrust bearings. A seized coupling is no better than a solid piece of shafting.

Wear and what to do about it

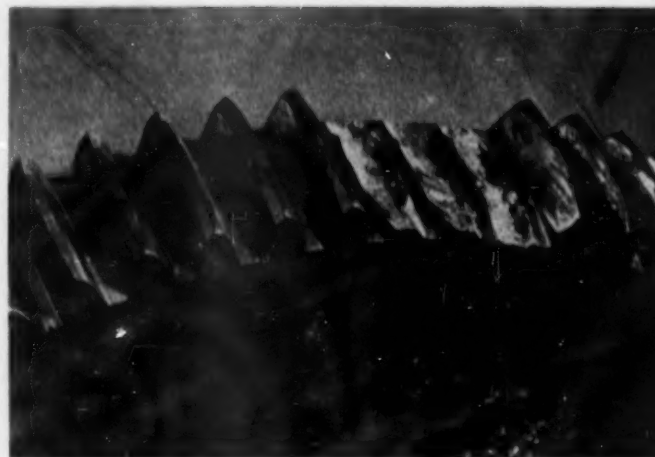
Different kinds of coupling wear need different corrective measures. Here are typical ways that gear-tooth couplings wear.

WELDING occurs when there is insufficient lubricant in the coupling. Heat of the teeth sliding against each other welds them together. The coupling is destroyed. You know what happened—correct it.

BREAKAGE normally occurs when teeth are badly worn. A mild shock or even normal load breaks the coupling. This coupling is a total loss. Don't attempt to add metal and remachine. The heat will distort



WELDING



BREAKAGE

the mating coupling parts and lock-in unwanted stress. Unless you are willing to risk even more serious failure, buy a new coupling.

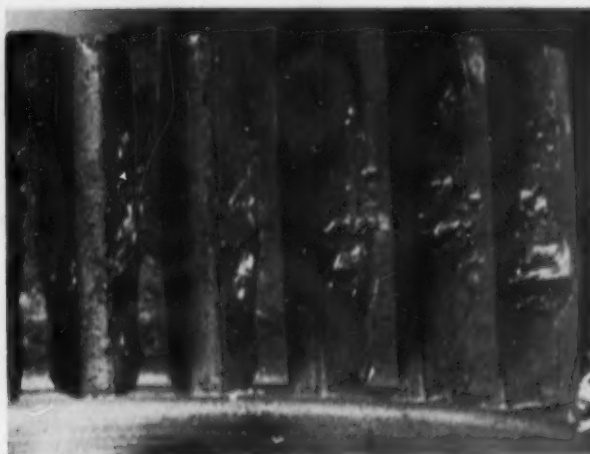
KNIFE EDGE indicates that the teeth are badly worn. Causes are old age, insufficient lubrication, incompatible coupling materials, or misalignment. Some of these may occur simultaneously—life can be very short.

SHOULDERS occur where male and female teeth are not in contact. A shoulder restricts axial motion. Usually, the worst effect occurs when coupling teeth develop shoulders as the machine operates normally at low power and generates a thrust—then operates at full power. The additional axial expansion required will overload the coupling. If wear of teeth is within permissible tolerance, it's possible to remedy this. Remove the shoulder with a scraper or file. Finish with a stone. Use bluing to check for high areas and correct contact.

SEVERE GALLING restricts axial motion by increasing friction. It's caused by hard particles be-



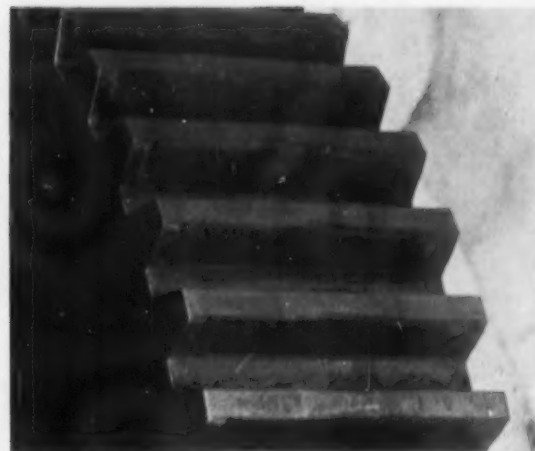
KNIFE EDGE



SEVERE GALLING



MODERATE GALLING



SHOULDERING

tween the teeth, poor lubrication, incorrect lubricant, or excessive misalignment. If galling is deep, or if general across the tooth face, replace the coupling. Use a sound length of tooth as a guide to determine amount of galling on other teeth.

MODERATE GALLING has the same causes as severe galling, but the effect of wear is less. Remove high spots and burrs. Do not attempt to remove the galling because it requires unnecessary removal of metal and probably will ruin the teeth.

INDENTING is the formation of a concave area in the longer face teeth by the shorter face teeth. The effect is the same as shouldering except that axial motion is restricted in both directions. Causes are very soft teeth, and long usage at the same power. In severe cases, the concave area will wear through completely. Indenting calls for replacement—the sooner the better.

SEVERE AXIAL SCORING is generally caused by the teeth sliding in contact. There are axial grooves in both male and female teeth unless one

member is considerably harder than the other. If the surface becomes too rough, the grooves may completely restrict axial movement. Excessive misalignment and inadequate lubrication are the causes. When there are many deep score marks, the coupling is beyond salvage. If a few teeth are scored, remove high areas and burrs only. Do not attempt to eradicate all of the scoring.

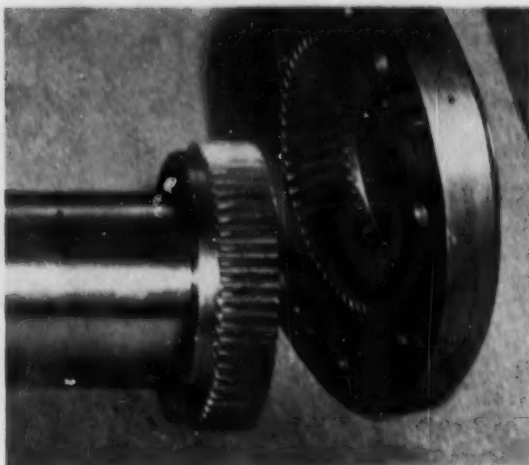
MODERATE AXIAL SCORING may be an early stage of severe axial scoring. Or, it may occur because particles get between the male and female teeth. This coupling can be salvaged. Light stoning is usually sufficient for dressing the teeth. Remove high spots with a scraper or fine file.

Charged-lubricant couplings

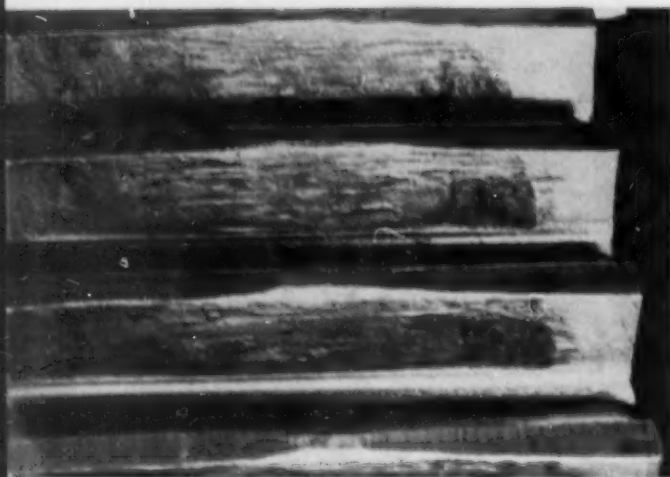
All couplings, of whatever size or transmitted power, need effective lubrication. Lack of lubricant results in very rapid wear or tooth seizure.

Charged-lubricant couplings use oil or grease. The coupling is charged with lubricant periodically.

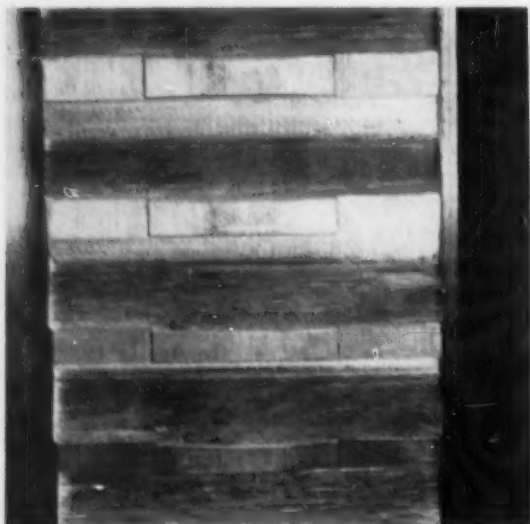
The lubricant absorbs the heat generated by slid-



INDENTING



SEVERE AXIAL SCORING



MODERATE AXIAL SCORING

ing. This heat is then transmitted to the metal coupling.

If the coupling is oil-lubricated, an SAE 90 hypoid or universal gear oil is satisfactory. For very high or very low temperatures, special oils may be necessary. When it's hot, you may need oil up to 1000 SSU at 210 F; when it's cold, you may need oil with a viscosity less than 100 SSU at 210 F.

Grease-lubricated couplings generally use a metallic-soap base with EP additives. Choice of grease is difficult for very high or very low operating speeds, or for cold weather. At high speeds, centrifugal force may separate oil from the grease soap. At very low speeds, centrifugal force may not distribute grease effectively. During cold weather, grease becomes hard and may not flow. Ask your coupling vendor to recommend lubricants for special jobs.

Inspect couplings every six months. Lubricate if necessary, but do not overfill. Examine teeth, backlash, alignment, and seals. If the coupling does not show wear, alignment is probably satisfactory. Replace broken, cracked, worn, or brittle seals.

Promptly investigate loss of lubricant from a coupling. If a freshly lubricated coupling throws lubricant at start-up, it may be too full. Inspect the seals to see if they were damaged or displaced. To detect leakage, place a piece of cardboard alongside the rotating coupling. Splatters on the cardboard show a leak.

If the lubricant has oxidized (consult manufacturer's tables), remove it. Also, remove any varnish or sludge that formed. Flush or clean the coupling with flushing oil or kerosene. Then, fill with fresh lubricant to proper level.

Couplings running where it's dusty may require more frequent inspection and lubrication.

On vertical couplings, inspect center bearing button and bearing plate for wear. Examine springs for shortening and breakage. Replace defective parts.

Whenever bolts and nuts are removed, examine them for cracks, elongation, and indentation. Make sure that locking friction is still available on self-locking nuts. If the nut drags hard when screwed on, it will probably be satisfactory. If in doubt, replace.

Always use new washers when reassembling fasteners that are locked by a spring lockwasher. Always lock shaft nuts securing a hub. Replace tab washers when reassembling the shaft. Always stake locking dowels. Follow manufacturer's recommendations when torquing nuts.

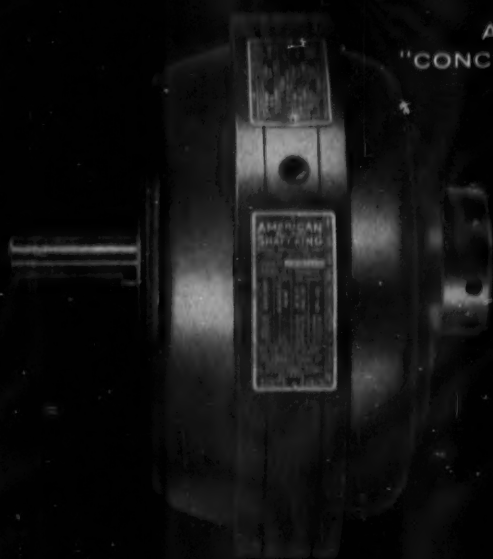
Feed-lubricant couplings

A force-feed system lubricates these couplings. The oil carries heat away from the coupling. A cooler cools the oil before returning it to the coupling. Some force-feed couplings do not contain oil dams. Oil passing the teeth lubricates them. A bearing feed line or separate nozzles supply the oil.

Inspect the couplings annually. Remove sludge and grit. Accumulated sludge may lockup the coupling.

Information given for charged-lubricant couplings about inspection of teeth, backlash, alignment, and bolts and nuts also applies to feed-lubricant couplings.

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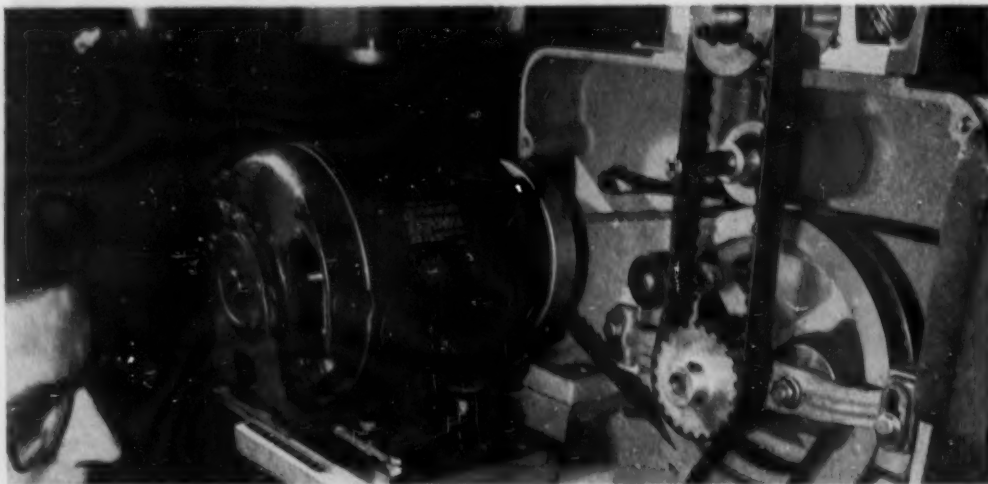
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December, 1961

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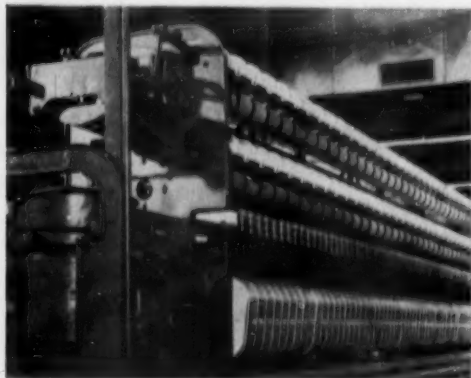
AT THE HEART OF INDUSTRY...



Teaming up for better projection...better sound, dependable US V-Belts and "Timing"® Belts are vital to the performance of Century movie projectors. These projectors must often run 12 hours in a row. The US belts insure silent running, keep projectors going at the exact speed required, guard against audience-annoying breakdowns.

VB 106

When industry wants power, in plant or product, it gets it with the help of US. Time after time, design engineers find they get more power, more efficiently...and at less cost...with U.S. Rubber products. For your needs in rubber, see US, the world's largest producer of industrial rubber goods.



A smoother running operation and better quality yarn are but two reasons why Kayser-Roth, producers of lingerie and hose, use 225 US Spinner Belts on stretch-yarn machines at their North Carolina plant. Each rugged spinner belt drives hundreds of spindles at high speeds and temperatures to 400°F... unlike others, doesn't shred or form dust that stains yarn.

SB 101



More than 6 times the life of other Variable Speed Belts, reports the Storm Lake, Iowa, plant of Hygrade Food. The first US Variable Speed Belt installed has already outperformed the previous belts by more than 6 to 1. What's more, it required no dressing or other maintenance and, unlike previous belts, has not developed uneven edge wear which shortens equipment life.

VSB 101



Chosen for overall top performance, U.S. Royal V-Belts drive the edger blade on Western Tool & Stamping Company's powerful Edger-trimmer. These belts must withstand oil, dust, weather, and twisting. They must also deliver top performance at many different engine speeds. U.S. Royal V-Belts do the job... were chosen because they outperformed all competitive belts.

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For every industrial rubber product need, turn to **US**. For Conveyor Belts, V-Belts, the original PowerGrip "Timing"® Belt, Flexible Couplings, Mountings, Fenders, Hose and Packings... custom-designed rubber products of every de-

scription. Discover why U.S. Rubber has become the largest developer and producer of industrial rubber products in the world. See your U.S. Rubber Distributor or contact **US** directly at Rockefeller Center, New York 20, N. Y.

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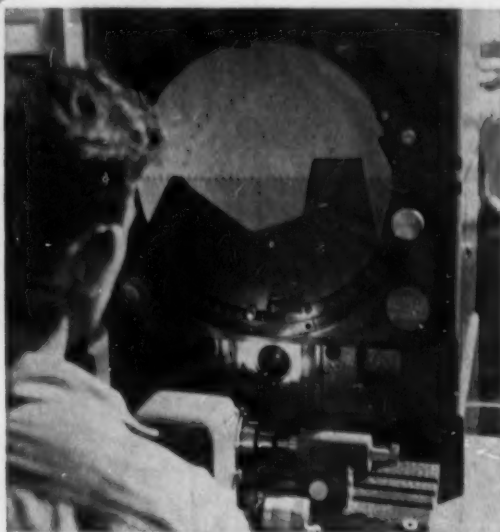
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Federal

BALL BEARINGS

One of America's largest ball bearing manufacturers



Circle 7 on Reader Service Card

smooth

A Federal forming tool must be more than merely naked-eye perfect. When it's magnified 50:1 in this Optical Comparator, and jibes to the letter with blueprint specs — then it's meeting the Federal toolroom standard. Care like this all along the line insures top performance from every Federal ball bearing — radial, angular contact, thrust, self-aligning or shafted. Single or double row. Open or sealed. Hundreds of types, in all sizes. See why so many of industry's best-known names rely on Federal? Contact your nearest authorized Federal Ball Bearing distributor. The Federal Bearings Co., Inc., Poughkeepsie, N. Y.

FEDERAL BALL BEARINGS ARE AVAILABLE THROUGH SELECTED DISTRIBUTORS FROM COAST TO COAST

BEARING SECTION

HAROLD BELANGER
bearings editor

Bearing Business

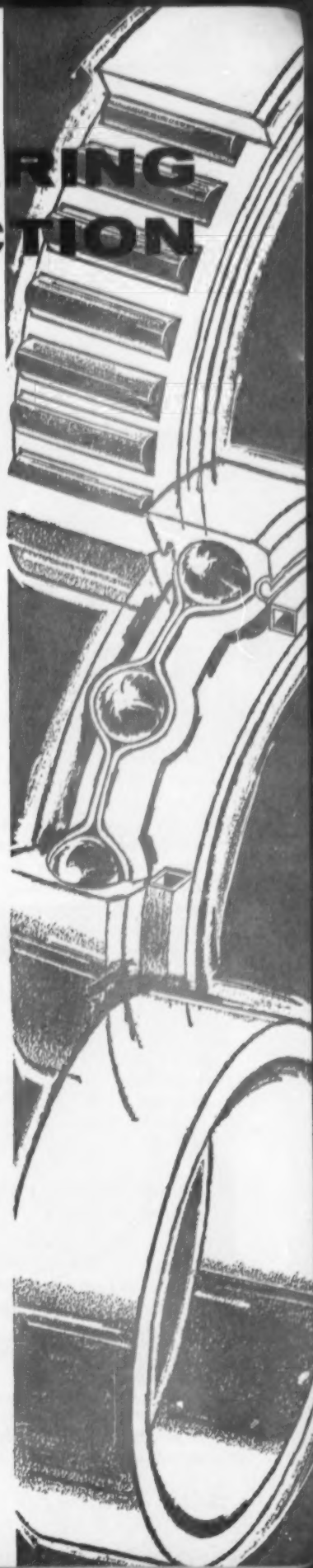
The Fafnir Bearing Co.—is manufacturing a new series of Teflon-lined bearings—both spherical and journal types. The standard spherical bearing has a woven Teflon liner between stainless steel bearing surfaces. The journal bearing is made of stainless steel with the Teflon bonded to the bore.

Marlin-Rockwell Corp.—has opened sales offices in Charlotte, N. C. and Boston, Mass. The new offices will handle sales to both the replacement and the original equipment markets.

New Hampshire Ball Bearings—began production of a new series of wide tolerance miniature ball bearings at the Laconia Division plant, on November 6. The plant started with 23 employees, will eventually employ several hundred. The company anticipates sales of between one and two million dollars for the first year. Main customers will be manufacturers of business machines including computers, comptometers, data processing machines; and also makers of some types of electric motors. Prices in the series, called LD bearings, average about 50 percent less than precision miniature ball bearings.

General Bearing Co.—appointed its wholly-owned subsidiary, BMB Corp., as exclusive sales agent for British Manufactured Bearings Co., Ltd., a leading manufacturer of miniature precision bearings. The British firm has been supplying critical components to military contractors in NATO as well as commercial bearings to major British manufacturers.

Bearing Headquarters Co.—announced the appointment of Julian Warczak as sales manager. Warczak has been with the company since 1946 in various sales management jobs.





1 DIRT OR METAL chips that got into the housing caused this damage. The broken separator has made the bearing completely worthless. Proper handling during the original installation could very probably have saved this bearing.

For extra life — HANDLE BEARINGS WITH CARE

ANTI-FRICTION BEARINGS are precision products. They are carefully cleaned by the manufacturer and thoroughly coated with protective lubricant before they are wrapped, packaged and sent to you. New bearings, you will find, are wrapped in grease-proof paper to keep them clean. Then there is a cardboard carton to protect them from physical damage. Keep them in the original cartons until you are ready to use them. If the package is opened, and the bearings not used straight away, rewrap them. Keep them clean and dry.

It is most important that you don't put your hands on new bearings. The perspiration and oils which are always on your hands will corrode new bearings. Handle them with clean hands and clean tools. Above all, don't wash the lubricant out of a new bearing. It is carefully selected and carefully applied for maximum bearing protection. Don't take the new bearings apart either. They were put together properly by the manufacturer, and it is unlikely that they will need any adjustment.

Mount bearings carefully, and avoid damage

The shaft on which the new bearing is to be mounted should be cleaned thoroughly. Keyways, splines, and grooves should be cleaned out and burrs and metal slivers should be carefully removed. When the bearings are put on, they must go on straight and squarely. Press only on ring which is in contact with the shaft. Press the bearings on until they seat against the housing shoulder. Never use a hammer on a bearing. It will damage it and may even crack it and ruin it completely. Probably the best way of mounting a bearing is with an arbor press (figure

2) if you have one. If you don't—use a vice. Place the inner ring on wooden blocks on the vice. Run the shaft down through the bearing as far as it will go. Put a tough hardwood block on top of the shaft, and hammer it into place. Tap fairly gently with the hammer and use it evenly in the center of the shaft. If the process is reversed, and the shaft is mounted in the vice, tap evenly all around the bearing surface. Remember, don't strike the bearing—strike the hardwood on it. If partial assemblies containing bearings are to be left for a while before being completely assembled, cover them. Don't leave them open to the atmosphere with its dirt, dust, and dampness.

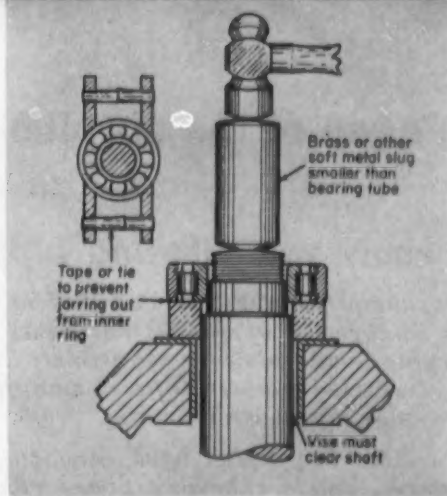
Bearings can be damaged during removal, too

Use the right tools and use them properly. Study the assembly and find the best way of cleaning it, and removing the bearings, before you start the job. Bearing housing should be washed off. All loose dirt should be very carefully removed so as not to allow it into the housing. If the bearings are properly removed, they can be used again and again. The arbor press used for putting the bearings on, is probably the best tool for taking them off. In the field, a bearing puller shown in Figure 4 is probably a simpler method than an arbor press. The bearing ring which turns with the shaft is usually a tight fit on the shaft. The stationary ring is usually loose. When a piece of equipment is taken apart the bearings stay with the member to which they are tightly fitted. In the case of bearings made of separable parts both rings could be a tight fit. So to remove the bearings, press or pull, wherever possible, only on

the ring which is tight. Press or pull straight and squarely to keep the ring from cocking. This could score the shaft or it could damage the bearing. Never press against bearing seals or separators. They are not intended to take it. If you don't have the proper tools, improvised tools will do the job, but they must be used correctly. A bearing should be supported on its inner ring, or inner and outer if they are flush-faced. But don't support just the outer ring during removal. Doing it this way puts a heavy stress on the balls or rollers. It can injure them and cause dents in both faces. Again—keep the tools clean. Before handling be sure you have a soft metal or hardwood block protecting the end of the shaft. Sometimes, instead of a vice, it is possible to use a tube which fits over the shaft onto the inner ring of the bearing. Protect the bearing surface with copper or a series of hardwood blocks.

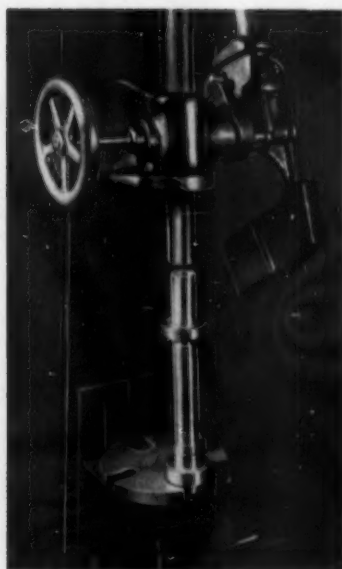
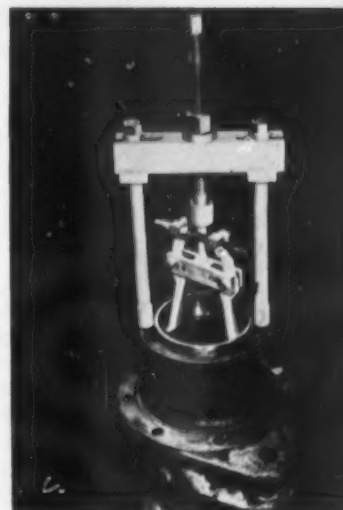
Sometimes a separable inner ring is installed against a shoulder of equal diameter so that there is no way to get hold of it. Leave the bearing ring on if it's usable. If it is not cut it off with a torch. Burn it partly through so as not to harm the shaft. This may loosen it enough to be able to pull it off. If not, crack it with a hammer and cold chisel. Take precautions to prevent personal injury during this procedure. Sometimes squeezing the partly-burned bearing ring in a vice will enable you to remove it more easily.

Technical assistance from the Anti-Friction Bearing Manufacturers pamphlet No. 100, on Bearing Maintenance.

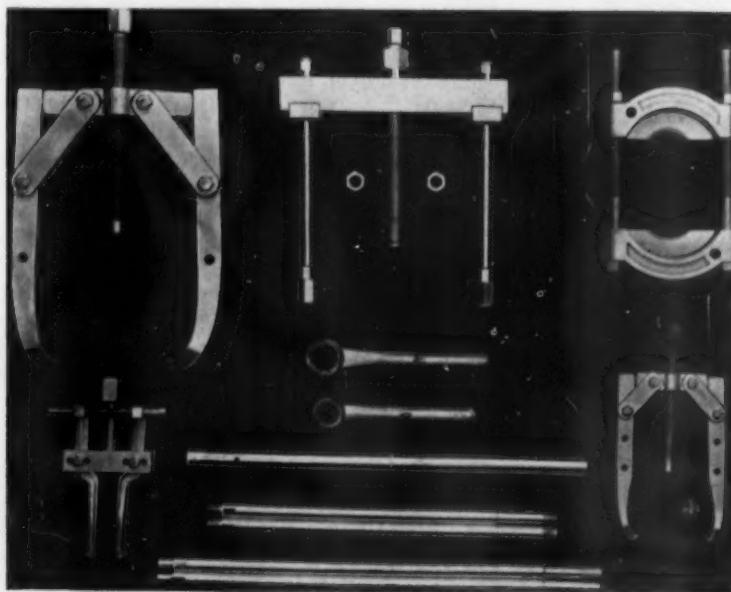


3 WITHOUT AN ARBOR PRESS, this method is adequate, and can be used for any kind of bearing. To remove the bearing, a soft metal slug is used between the end of the shaft and the hardened steel hammer.

4 USING A PULLER in the field. Many types are also able to push a bearing onto its shaft, as in this case. The puller must be adjusted so as to pull on the inner ring. Any other arrangement will damage, and possibly ruin, the bearing.



2 ARBOR PRESS is equally useful for mounting and removing bearings. In this instance, the lower bearing was taken off for inspection. As it was properly installed to begin with, it undoubtedly proved to be as good as new.



5 TYPICAL PULLERS, that can be used singly, or in various combinations to put on, or remove complete bearings, or individual rings. Pressure must be applied evenly to the bearing, otherwise the shaft may be gouged, or scored. Never pull against shields or separators.

The case of the surplus scandal

... know your bearing supplier

Bearing manufacturers are outraged at the recent discoveries of forged packages. Some dealers in surplus goods may be unwittingly selling junk under respected names. Others, manufacturers believe, may not be so unwitting.

Most dealers in surplus have adequate inspection procedures, and are beyond blame. They are invaluable as sources for obsolete types of bearings. Whom do you buy from?

By HENRY LEFER, Eastern Editor.

A MAN WHO NEEDED CASH faked a handful of invoices. They showed bearings he supposedly had shipped to customers. On the strength of the fake invoices, he borrowed money from the bank. The system worked fine until he was caught.

So he was given time to consider his mistake—in jail. There he met another inmate, whom Uncle Sam was trying to dissuade from printing his own money. They sobbed out their sad tales, and determined to repent, to never again tangle with the Secret Service and the auditors.

Instead, they decided to counterfeit the boxes and labels of leading bearing manufacturers. They bought government surplus bearings from surplus dealers at about one tenth of their original price, repackaged them in their own new boxes. They then re-sold them at cut rate prices. They also supplied hundreds of thousands of counterfeit boxes to surplus dealers: these latter packed bearings in these boxes. They made a healthy profit.

There was another man, who found what he thought were new bearings, made by leading manufacturers, selling at half price. Not long after, his equipment suffered a series of expensive breakdowns. The trouble? Defective bearings.

This is a true story. Although these two con men were caught with most of their counterfeit boxes and printing plates, thousands of fake boxes are still believed to be scattered over the U. S. and overseas.

Packages of several leading manufacturers have been counterfeited. One fake was so skillful that the manufacturer himself couldn't tell it from the real thing. It took the printer to point out minute differences between the counterfeit and the authentic printing.

The counterfeiters trade on the fact that everybody

Continued on page 42

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DISTRIBUTORS for ASARCON
CONTINUOUS-CAST BRONZE:

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Dixie Bronze Co., Inc.
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J. M. Tull Metal & Supply Co., Inc.
FAIRFAX 3-1612

ARKANSAS
Little Rock
Arkansas Foundry Company
FRANKLIN 2-6261

CALIFORNIA
Los Angeles
Kingwell Bros., Ltd.
LUDLOW 2-7427
San Francisco
Kingwell Bros., Ltd.
SUTTER 1-0514

CONNECTICUT
Guilford
Knapp Foundry Co., Inc.
GLENDALE 3-2744
Seymour
The Derby Castings Co.
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Stratford
The Ellsworth Industrial Supply Co.
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J. M. Tull Metal & Supply Co., Inc.
EVERGREEN 7-5561
Miami
J. M. Tull Metal & Supply Co., Inc.
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Tampa
J. M. Tull Metal & Supply Co., Inc.
TAMPA 3-6741

GEORGIA
Atlanta
J. M. Tull Metal & Supply Co., Inc.
JACKSON 5-3871

ILLINOIS
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Bearing Headquarters Co.
Div. Ray M. Ring Co., Inc.
ESTEBROOK 9-0300
Bronze Bearings, Inc.
JUNIPER 3-1160
Peoria
Ray M. Ring Bearing Co.
PEORIA 6-73-8171
Rockford
Rockford Tool & Transmission Co.
ROCKFORD 2-7711
Waukegan
Bearing Headquarters Co.
Div. Ray M. Ring Co., Inc.
MA 3-5212

INDIANA
East Chicago
Bearing Headquarters Co.
Div. Ray M. Ring Co., Inc.
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Indianapolis
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Jones & Laughlin Steel Corp.
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South Bend
Powell Tool Supply, Inc.
ATLANTIC 9-5578

KENTUCKY
Louisville
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LOUISIANA
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Standard Brass & Mfg. Co.
AUDUBON 1381
Shreveport
Standard Brass & Mfg. Co.
UN 5-4241

MARYLAND
Baltimore
Bronze Specialties, Inc.
LEXINGTON 9-1906

MASSACHUSETTS
Boston
Kaiser Metal Products Co.
HUBBARD 2-1737
Hillard Brass & Copper Co.
HIGHLANDS 2-6220

MICHIGAN
Detroit
Copper & Brass Sales, Inc.
FOREST 6-4200
Meier Brass & Aluminum Co.
JORDAN 6-3802
Grand Rapids
Copper & Brass Sales, Inc.
EMPIRE 1-6681
Kalamazoo
Bard Tool and Equipment Co.
FIRESIDE 3-2691
Lansing
Superior Brass & Aluminum Co.
IV 2-2754
Muskegon
Tremco Hardware & Supply Co.
2-2651

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R. G. Elde, Inc.
TE 8-4846

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Associated Bearings Co.
HARRISON 1-0427
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R. J. Bearing Co.
MISSION 7-3605

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The Island Supply Co.
DUPONT 2-8567
Omaha
T. S. McShane Co., Inc.
JACKSON 1273
NEW JERSEY
Carlsbad
E. A. Williams & Son
GENEVA 8-0800
MARKET 3-1929
(New York LA 4-9546)

NEWARK
Federal Bronze Products, Inc.
MARKET 2-6330
Perry Amboy
Gregg's Brass Foundry
HILLCREST 2-2086

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Hansley, Inc.
STERLING 8-1144
Buffalo
Kencroft Associates, Inc.
RIVERSIDE 1520
Rochester
Ontario Metal Supply, Inc.
HAMILTON 6-1630
Syracuse
Melcon Bronze Foundry, Inc.
GLENVIEW 4-3231
Troy
The Troy Belling & Supply Co., Inc.
AS 2-4820 (in Albany 3-6121)

OHIO
Akron
Akron Welding and Spring Co.
JEFFERSON 5-2187
Cleveland
Copper & Brass Sales, Inc.
VV 1-8300
The Bearing Bronze Co.
MICHIGAN 1-6520
Cincinnati
Reliable Castings Corp.
KIRBY 1-2527
Columbus
Williams & Co., Inc.
AXMINSTER 4-1823
Dayton
The Bristol Brass Corp. of Ohio
BALDWIN 8-8185
Toledo
The Sagar Brass Company
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Williams & Co., Inc.
GREENWOOD 5-8661

PENNSYLVANIA
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R. T. Schaller Co.
BL 2-2435
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GLADSTONE 7-2500
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Houston
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RI 7-1220
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BROADWAY 2-0231

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How ASARCON Bronze cut to length saves you money

Each time your machinist is left with a costly scrap end from a cast bronze bar, the dollar economy of cut-to-length, continuous-cast Asarcon Bronze is re-emphasized.

When you use 13" cast bars, you have a remnant problem. For example, a 1" remnant from such a bar is over 7.6% loss, a 1½" piece is over 11.5% loss, a 2" scrap is over 15.3% loss. And the cost of the finished parts *must* include the purchase price of these remnants.

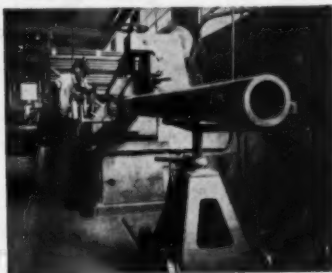
However, you can buy continuous-cast Asarcon Bronze from stock in lengths up to 105" and cut off short pieces as required, or you can buy cut-to-length pieces to meet each job's specifications. You can eliminate both inventory costs and waste of expensive metal.

In addition to savings on end scrap, Asarcon Bronze bars provide these minimum clean-up allowances: ⅛" on diameters up to 4"; ¼" on diameters from 4" to 5"; ⅜" on diameters from 5" to 9".

Other important advantages of Asarcon cut-to-length bronze:

- Available from stock in 263 sizes, solids and tubes, from ½" to 9" in diameter.
- Superior metallurgical characteristics — no blow-holes, pits, shrinks, hard or soft spots.
- Better physical properties due to higher tensile, yield and impact strengths; greater resistance to metal fatigue.

For further information, call or write your Asarcon distributor or write: Continuous-Cast Dept., American Smelting and Refining Company, Perth Amboy, N. J., or Whiting, Ind.



Cutting stock length of 9" O.D. Asarcon Bronze tubing to exact length specified by customer.

Circle 2 on Reader Service Card

ASARCON[®] BRONZE

SURPLUS SCANDAL

Continued from page 40

likes a bargain. But nobody wants defective goods, and in bearings, the two usually go together.

Why so? Surplus bearings are top-quality products, built to tight government specifications. Bearings are made of high-grade steel. Shouldn't they be as good as new after 10 to 20 years in a spare parts inventory? Aren't the manufacturers just trying to protect their products and prices?

The facts—bearings don't last indefinitely on the shelf. Lubricants and rust inhibitors may spoil and oxidize, allowing the bearings to pit and rust. In military storage, the bearings got all sorts of rough handling, all sorts of storage.

Even in untouched condition, they may not be as good as the bearings made today. In the last 20 years, manufacturers have improved rolling-element bearings. They have radically changed the internal design, improved the geometry of races and rolling elements, cage designs, seal designs, noise characteristics, and overall tolerances. They use better greases and slushing compounds. And these changes apply even though the bearing designations remain the same.

Among the counterfeits seized have been bearings with nicked surfaces. Some had been polished to get rid of rust on visible surfaces, but the interiors were still rusted and pitted. Some had had the original slushing compound replaced with a grease whose origin and composition—and characteristics—were unknown to the maker whose label they bore.

Surplus bearings probably will be in good supply for a long time to come. Military vehicles and equipment are sold to the government with a complement of spares that includes bearings. When the vehicle (or aircraft, etc.) becomes obsolete, so do the spare parts. The law then requires the government to dispose of them as surplus.

The government's point of view

Annoyed taxpayers ask, "What's wrong with government procurement?" They want to know why a bearing being sold as surplus in one office is being bought at full price in another. The same bearings have been repurchased occasionally in counterfeit packages.

This question is a lot easier to ask than to answer. Government inventorying is complicated. Every part

used in one vehicle, for instance, is given a part number that ties it to that vehicle. Although the same part (a bearing, for instance) may be used in other places—on a ship's pump, for example—they will have different numbers. To find all the uses of each part, and to make consolidated records of them would be practically impossible. Certainly, it would cost enough to make the taxpayers scream. Cross-referencing, and cross-indexing the multimillion government inventory would cost considerably more than disposing of surplus and reordering.

The government admits that selling surpluses often costs more than the sale brings in. This is certainly so with most bearings. A high official of the Business and Defense Services Administration of the Department of Commerce told POWER TRANSMISSION DESIGN that between \$6 and \$8 million worth of bearings will be sold as surplus this year. They will bring in around \$6 to 8 hundred thousand. He suggested that the sale procedures will cost much more than this, and that he would like to see them scrapped.

Offers possible solution

One possible solution has been aired informally.

Since the biggest obstacle to an agreement, probably, is the manner of deciding who buys what, manufacturers have suggested segregating all surplus bearings by maker. But the Government replies that products made to one specification for one machine were mixed under a common stock number. To separate them would involve an inspection of every bearing at an enormous expense. Even to start segregating bearings by maker would be very expensive, and the results might not show up for 10 to 20 years—by which time there may be a better solution.

Meantime, manufacturers have warned their customers that only new bearings in original factory packaging will be covered by the manufacturers' warranty.

Some manufacturers have sent circulars to their OEM customers, telling them that makers assume no responsibility for bearings—ostensibly their own—not purchased through authorized channels.

One industry official told us,

"As long as bearings are worth practically their weight in gold, some shady characters will try to take advantage of this surplus situation.

"The customer's only safe course, whether he's buying new or surplus bearings—is to deal with established sources."

E. R. Broden, President and Chairman of the Board of SKF Industries and Chairman of the Anti-Friction Bearing Manufacturers Assoc. says . . .

"Any proposals aimed at solving this problem—currently being studied by the Anti-Friction Bearing Manufacturers Association—must adequately safeguard the buyers.

"The occurrence reported here serves to emphasize the need of an expanding industry to

increasingly find ways and means of assuring proper protection and product performance.

"The AFBMA is actively engaged in seeking the detailed information and facts which will enable it to make sound recommendations designed to serve the public and the industry."



simply say Delco

**AND THE MAN WITH THE RED PHONE WILL SOLVE
YOUR BEARING PROBLEM ANY TIME!**

Your *authorized* Delco New Departure and Delco Hyatt Bearings Distributor may be watching the late, late movie, but his Red Phone Service stands ready—*any time*—for immediate delivery of bearings. In his warehouse are thousands of types and sizes of bearings, standard and special, more than likely the one you need. ■ He's backed up by the Red Phone Network, a unique direct line service that commands all Delco New Departure and Delco Hyatt bearing stocks in factory warehouses across the country . . . more than 7,000,000 bearings! The bearing you want, wherever it is, can be delivered in a matter of hours. ■ Delco New Departure and Delco Hyatt Bearings are the standards of industry—dependable, durable and precise. They're providing exceptional service on virtually every type of industrial equipment in use today. ■ So whenever you replace bearings—in routine maintenance or emergency, call the Bearings Distributor who gives Red Phone Service. Specify **Delco New Departure** and **Delco Hyatt Bearings**, distributed nationally through **United Delco**.

UNITED MOTORS SERVICE, Division of General Motors

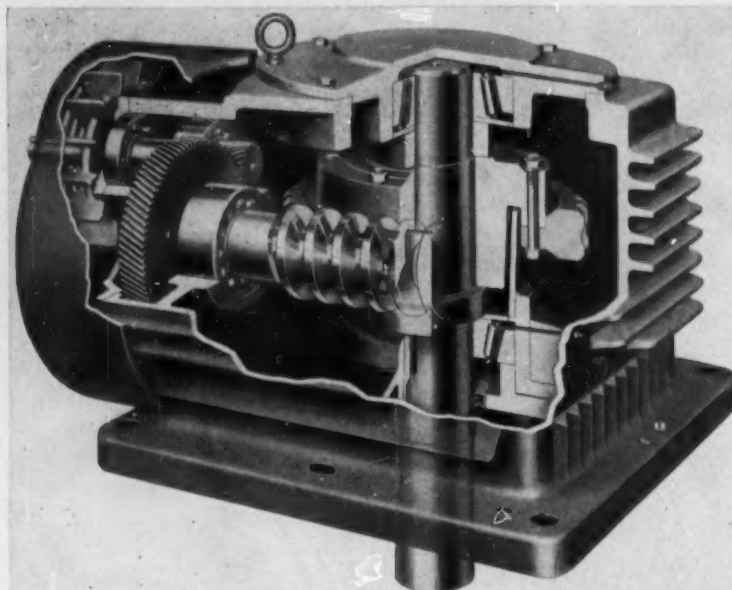


Circle 30 on Reader Service Card

PRODUCT NEWS

Helical double reducers

Output shaft extends either up or down. Fan cooled.



The HUF and HDF reducers come in ratios from 35:1 to 250:1, fractional to 60 hp, output torque up to 145,000 in. lb. The HDF (downshaft) reducer shown has a dry-well lubricant system. In the HUF types (upshaft) the helical and worm gearing runs in a large capacity oil bath for both cooling and lubrication. Gears are hobbled, crown-shaved and flame-hardened to withstand momentary overload

of 300 percent. Centrifugally-cast bronze worm gears in the HUF types are either solid or have rims welded to cast iron hubs. In HDF types, worm gears are either centrifugally cast onto a cast iron hub, or have flange-type rims bolted to the hub. Aluminum or plastic cooling fans are mounted on the high speed pinion. *Eaton Mfg. Co., Cleveland Worm & Gear Div., Cleveland.*

Circle 200 on Reader Service Card

Belt-driven torque converter

For 3 to 7½ hp gas engines and some types of electric motor.



New model 500 has load-free idling; 3:1 ratio in low (over 1650 rpm); and 1:1 ratio in high (over 2200-2600 rpm). Main feature is the pulley-controlled belt tension which stops slippage between drive and driven pulley. *Salsbury Corp., Los Angeles.*

Circle 201 on Reader Service Card

Brakes with bonded linings

No rivets to score brake drums.

Bonded linings are five times stronger than riveted types, with 10 percent greater braking surface from eliminating the rivet

holes. The linings are bonded to steel backplates over their entire surface.

The new linings, now standard on Type IC9528 brakes, are interchangeable with riveted types. *General Electric Co., Schenectady.*

Circle 202 on Reader Service Card

Flexible shaft steering link

For steering columns of trucks, automobiles etc. allows wheel to be pushed to one side.

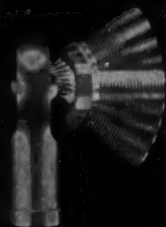


Shaft has spring tension which brings the wheel back to the straight position. It will collapse in a crash, preventing driver injuries. The core, made of music wire comes in ½ or ¾-in. sizes. It allows steering column to be deflected 20 degrees or more depending on shaft length. The ¾-in. core shown has hexagonally-crimped fittings and a breaking strength of 4600 in. lb. *Stow Mfg. Co., Inc., Binghamton, N. Y.*

Circle 203 on Reader Service Card

Continued on page 46

The READER SERVICE CARD is on page 48. Use it to get information quickly on any of these items



What makes *Alinabal* ROD ENDS better?

One reason for the superior performance of Alinabal Rod Ends and Spherical Bearings is the precise control of the relationship of the spherical race to the ball.

Each Alinabal unit has a precision ground, through hardened steel race. Precise control of the race radius enhances low friction operation and prevents "end-loading" effects. This spherically ground race is manufactured for assembly around the ball, and is not a set of relatively soft, pressed inserts, nor is it a swaged housing. Moreover, loading slots are not used in the Alinabal construction method. Thus, the ball is positively and permanently retained under misaligning conditions.

Alinabal is the registered trade name for rod ends and spherical bearings manufactured under U.S. Patent 2,781,238.

A complete line — standard male and female rod ends — stud type rod ends — standard spherical bearings and rod linkages — sizes range from 3/16" to 4" bore.

SEND FOR COMPLETE CATALOG

 split ballbearing
SBB DIVISION OF **MPB**
INCORPORATED
LEBANON, NEW HAMPSHIRE

New Electro- Magnetic Clutch

Size 8, Style SMR



Only 8-in. Diameter... Offers 1740 lb-in. Torque

Remarkably high torque-to-size ratio simplifies application. Ball-bearing-mounted stationary magnet body eliminates slip rings. Encapsulated field coil and solid armature assure reliability. Excellent for packaging machinery, textile machinery, machine tools, etc.

Stearns SMR clutches are furnished in nine sizes, from 2 to 1740 lb-in. torque for all standard DC voltages to 90 volts — class A through H insulation — with integral sprockets or sheaves in split and thru-shaft arrangements. Also available as a flange-mounted brake.

Write for Clutch Data File NPP 12-61C.

Stocked by distributors in principal cities



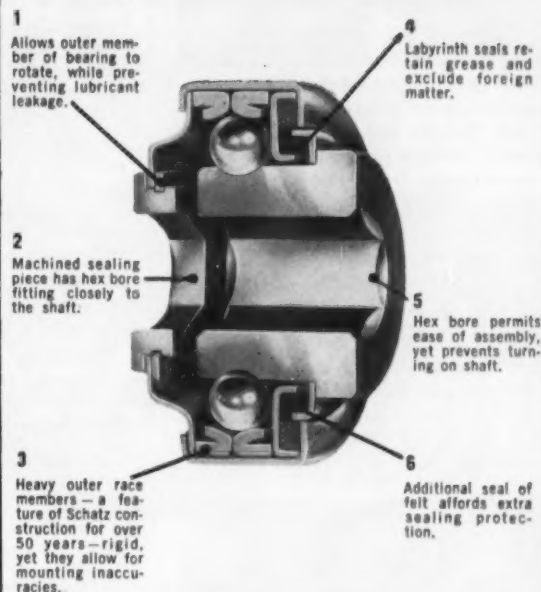
Stearns
ELECTRIC CORPORATION
120 NORTH BROADWAY
MILWAUKEE 2, WISCONSIN

Circle 26 on Reader Service Card

December, 1961

When low bearing cost is a must...

but you need all these features, too



This is Schatz "Commercial" Ball Bearing #CS-3174x3. It is prelubricated, ready for heavy duty.

And, it is cutting costs on production lines everywhere—both by its initial price and through its operating performance.

Given the right applications, "Commercial" ball bearings can shave *your* component budget, too. Schatz engineers have been doing it for industry for over 50 years. For the complete line of Schatz bearings has been designed to provide

*all the precision you require—and need
pay for—for numerous applications.*

Let us show you how these cost-saving bearings fit your production program. Write for Catalog 12.

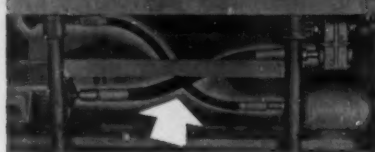
The Schatz Manufacturing Company, 7640 Fairview Ave., Poughkeepsie, N. Y.

See our ad in SWEET'S

SCHATZ
"Commercial"
BALL BEARINGS

Circle 22 on Reader Service Card

Here's how **Elliott**
Flexible Shafts
are Saving
TIME and MONEY



Two Elliott Standard Flexible Shafts drive special processing machine and vibrator operating simultaneously. Flexible Shafts isolate vibration of table from motors.



Four 3/4" Standard Flexible Shafts used in special production machinery in box manufacturing company eliminate parts and intricate mechanism.



Safety is enhanced, appearance improved by coupling bale loader to tractor's power take-off with a Standard Flexible Shaft. Separate gas engine for loader is eliminated.

One Elliott Flexible Shaft assembly can replace many parts, saving assembly time and labor. In one application, a Flexible Shaft for a textile machine replaced 50 parts, reduced cost of original mechanism by two-thirds.

Write for our
Catalog 263



**'FLEXIBLE SHAFT DATA
FOR DESIGNERS'**

B.W. ELLIOTT MFG. CO., INC.

251 State St., Binghamton, N. Y.

Circle 6 on Reader Service Card

PRODUCT NEWS

Heavy-duty U-joints and drives

Include telescoping and safety shielded assemblies.

Telescoping assemblies are round-tube and sleeve-type construction, with maximum extended length of 90 in., minimum compressed length of 14 1/2 in.

End yokes, in a range of bore sizes, come in standard, square, heavy and long types, with clamp and quick disconnect types for tractors. One needle bearing journal cross kit serves for any combination of yokes; all yokes are interchangeable. Performance ratings: 55 hp at 550 rpm; torque, 10,000 in.-lb; maximum operating angularity, 45 degrees; maximum static angularity, 90 degrees. Neapco Products Inc., Pottstown, Pa.

Circle 204 on Reader Service Card

Rotary transducers

Convert mechanical motion into digital voltage pulses.

Called Rotopulsers, they divide into two basic designs—the Zero Speed and the Magnetic types. The shaft of the Zero Speed type rotates a precision-ruled disc which interrupts a built-in light source, thus feeding pulses to a controller or readout device. The Magnetic



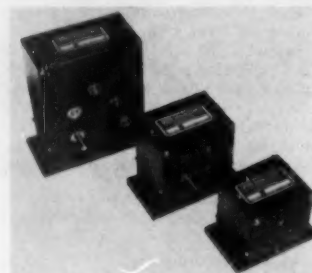
type has a precision-engineered rotor with individual teeth to represent any desired unit of measurement. Pulses are fed directly to remote readout and control devices as the shaft rotates the teeth through a magnetic field. Rotopulsers can be used with preset counters, controllers, tachometers, total-

izers rate indicators and many readout and control devices. They measure length down to 1/1000 in., or speed down to 1/100 rpm. The Louis Allis Co., Milwaukee, Wisconsin.

Circle 205 on Reader Service Card

Servo gear boxes

New line has over 720 variable units with even binary ratios from 2:1 to 625:1



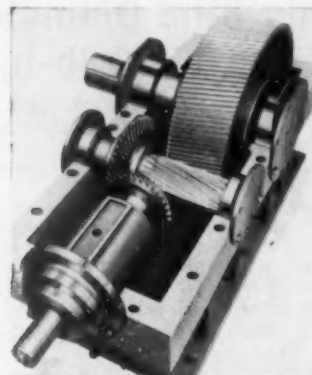
Output shaft backlash with input shaft locked is held to a max. of 30 minutes. Output torques from 250 in. oz for the 1/8 in. shaft series to 500 in. oz for the 1/2 in. shaft. Light medium and heavy duty models. Boxes allow for a wide variation in design and mounting arrangements. All types available with slip clutch, anti-backlash gears or a combination of both. PIC Design Corp., East Rockaway, L. I., New York.

Circle 206 on Reader Service Card

Right angle drives

Heavy duty helical gear types in double and triple reduction. AGMA ratings.

The new Maxi-Power line has a very heavy fabricated-steel housing designed to keep bearings and



gears aligned even under outside impact. Final reduction gearing is hobbled. Anti-friction bearings on

Continued on page 50

POWER TRANSMISSION DESIGN

REPRINTS

The following reprints of feature articles from **POWER TRANSMISSION DESIGN** Magazine are available:

ELECTRIC MOTORS

Complete coverage of ac and dc types. Includes large Buyer's Guide. From Nov., Dec., 1960 and Jan. 1961 issues. Thirty-two pages.

1-9 copies \$1 each
10-49 copies 75c each
Over 50 copies, 50c each

WHY A UNIVERSAL JOINT

Types, operating angles, selection and installation principles. Buyer's Guide, plus three case histories. From Oct. 1961.

1-9 copies, 25c each
Over 10 copies, 15c each

CLUTCHES AND BRAKES

An introduction to both friction and positive contact types. From June and July 1960 issues. Sixteen pages.

1-9 copies, 75c each
10-49 copies, 50c each
Over 50 copies, 30c each

GEARMOTORS

Put the power where the work is—with a gear-motor. From Jan. 1960 issue. Twelve pages.

1-25 copies, 25c each
Over 25 copies, 10c each

NOMOGRAMS

Six nomograms for complete mounting of pivoted motor, base and accessories.

Copies 15c each

Send all orders—enclosing the exact amount in coins or checks—to: **POWER TRANSMISSION DESIGN**, 812 Huron Road, Cleveland 15, Ohio.

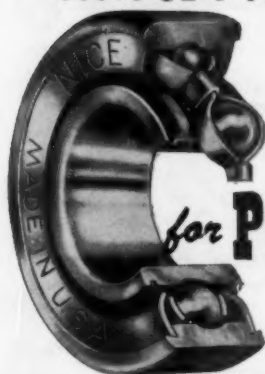
looking for **STRONG** and economical chain?



LOCKE STEEL PINTLE CHAIN

THE LOCKE STEEL CHAIN COMPANY ★ HUNTINGTON, IND.

COSTS UP? PROFITS DOWN?



Try
NICE
for Performance
and Price

Cost-conscious manufacturers will find many cost-saving advantages offered by NICE Ball Bearings. NICE can provide a complete range of standard or custom designed unground, semi-precision and precision bearings—and Product Designers can select bearings that insure a properly functioning product, yet one that is economically produced and competitively priced.

When cost is a problem... yet quality is a **MUST**
... try NICE, for Performance and Price

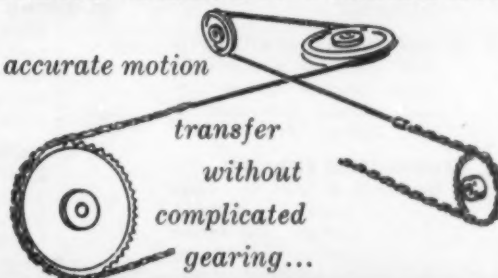


NICE BALL BEARING CO.

NICETOWN • PHILADELPHIA • PENNSYLVANIA

MORE DESIGN FREEDOM

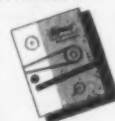
accurate motion



SIERRA MINIATURE MECHANICAL CHAIN AND SPROCKETS...

Provide precise, positive motion transfer through several planes simultaneously with no cable slippage...no complicated gearing. Unlimited center-to-center selection for miniature and sub-miniature assemblies in servo systems, gyro systems, special cameras, electronic equipment, and small precision instruments. Less weight, cost, maintenance—wider tolerances. Designed to operate around minimum 7-tooth sprocket with root diameter of .250 inches. Chain pitch .1475 inches; Weight .45 oz. per lineal ft. Material: stainless steel, or other materials.

NEW CATALOG



Contains useful application data, specifications, tables on chain pitch and sprocket sizes, suggestions for calculating center-to-center distance. Write for yours today.

Sierra

ENGINEERING
COMPANY

123 East Montecito • Sierra Madre, California

T. M. REG.

Circle 19 on Reader Service Card

December, 1961

Circle 21 on Reader Service Card

FREE REFERENCE MATERIAL

FROM THIS MONTH'S ADS

1. PLASTIC METAL SEALANT—

American Sealants Co.—Liquid sealant locks metals parts, eliminates pressfits, shaft distortion, keyways, etc. Literature and free sample.

2. BEARING BRONZE—American

Smelting and Refining Co.—Tells you how to save money by specifying ASARCO bronze in standard lengths.

4. CUSTOM GEARS AND GEAR

BOXES—Cincinnati Gear Co.—Custom gears made in all types to 72 in. diam. cut teeth, 39 in. shaved teeth, 25 in. ground teeth. Brochure.

5. MAGNETIC CLUTCHES, BRAKES

—Eaton Dynamatic Div.—The Dyna-Torq line of magnetic friction clutches and brakes offers accurate power control, rapid response, low maintenance.

6. FLEXIBLE SHAFTING—Elliott Mfg.

Co.—One flexible shaft assembly can replace many parts, saving assembly time and labor. Catalog 263.

11. ADJUSTABLE SLIP CLUTCH—The

Hilliard Corp.—Clutch limits torque, protects against overloads, resumes drive automatically. Bulletin 300.

12. HELICAL SPEED REDUCERS—The

Horsburgh & Scott Co.—Large stock of patterns and blanks, special equipment and tooling for specifications or custom designs. Write for details.

14. TORQUE OVERLOAD CUTOUT—

Holtzer Cabot, Jannette Motor Div.—Adjustable cutout shuts off driving motor within closely controlled limits, is easily reset after overload. Bulletin 5-7.

16. LINK V-BELT—Manheim Mfg. &

Belting Co.—Save store room space by replacing different types of belting with Veclos. Details in Data Book.

17. BELT AND CHAIN DRIVES—

Maurey Mfg. Corp.—Complete drive line includes fhp and multiple types. Positive drives

OFFERED FOR THE FIRST TIME . . .

The services and reference materials listed here are being offered by advertisers to readers for the first time

3. CYCLOIDAL REDUCTION

DRIVES—Black Tool Co.—Ratios of 15:1 through 174:1 are available in a single stage of reduction. Explained in New Master Catalog RD-61.

8. CLUTCH REBUILD SERVICE

—Clutches are rebuilt in 5 to 10 working days. Catalog 105B.

26. ELECTRO-MAGNETIC

CLUTCH—Stearns Electric Corp.—SMR clutches come 9 sizes from 2- to 1740 in.-lb for all standard dc voltages to 90 volts. Ball-bearing-mounted stationary magnet body eliminates slip rings. Also available as a flange mounted brake. Clutch Data File NPP 12-61C.

spring-loaded pulleys, etc, Catalogs and manuals.

18. AIR CLUTCHES—Minster Machine

Co.—Increase die-press efficiency by installing an air clutch assembly. Clutch Conversion Booklet CC 57.

20. SPRING LOADED CLUTCHES—

Rockford Clutch Co.—High-quality facings and properly spaced engagement springs give maximum driving contact. Literature.

21. MINIATURE CHAINS & SPROCKETS—Sierra Engineering Co.—

Accurate motion transfer through several planes without gearing. Catalog gives data and spec tables.

22. PRE-LUBRICATED BALL BEARINGS—Schatz Mfg. Co.—

Heavy-duty bearings use labyrinth and felt seals to prevent lubricant leakage. Catalog 12.

24. ELECTRIC CLUTCH BRAKE—

Simplatrol Products Corp.—The diaphragm is the only moving part of this assembly. Literature gives details.

25. ROD ENDS—Split Ballbearing Div.

MPB, Inc.—Complete line of male and female rod ends, stud types, standard spherical bearings and rod linkages. Complete catalog.

20. MAGNETIC DRIVE—Tormag Div.,

Glendon Reel Corp.—Design works through eddy-currents developed by permanent magnets. Gives frictionless, shockless drive.

29. PILLOW BLOCKS—Triangle Mfg.

Co.—Blocks are self-aligning, self-lubricating sleeve-type. Offered in a wide selection of mountings. Write for literature.

31. ELECTRICAL ADJUSTABLE

DRIVES—U. S. Electrical Motors, Inc.—Speed setting cannot drift or creep with new Vari-drive control yet setting can be easily adjusted. Brochure F-1797.

33. DIFFERENTIAL SPEED REDUCERS

—Winsmith, Inc.—Reducers have integral primary and secondary planetary gears, with a 15 degree helix angle. Write for information.

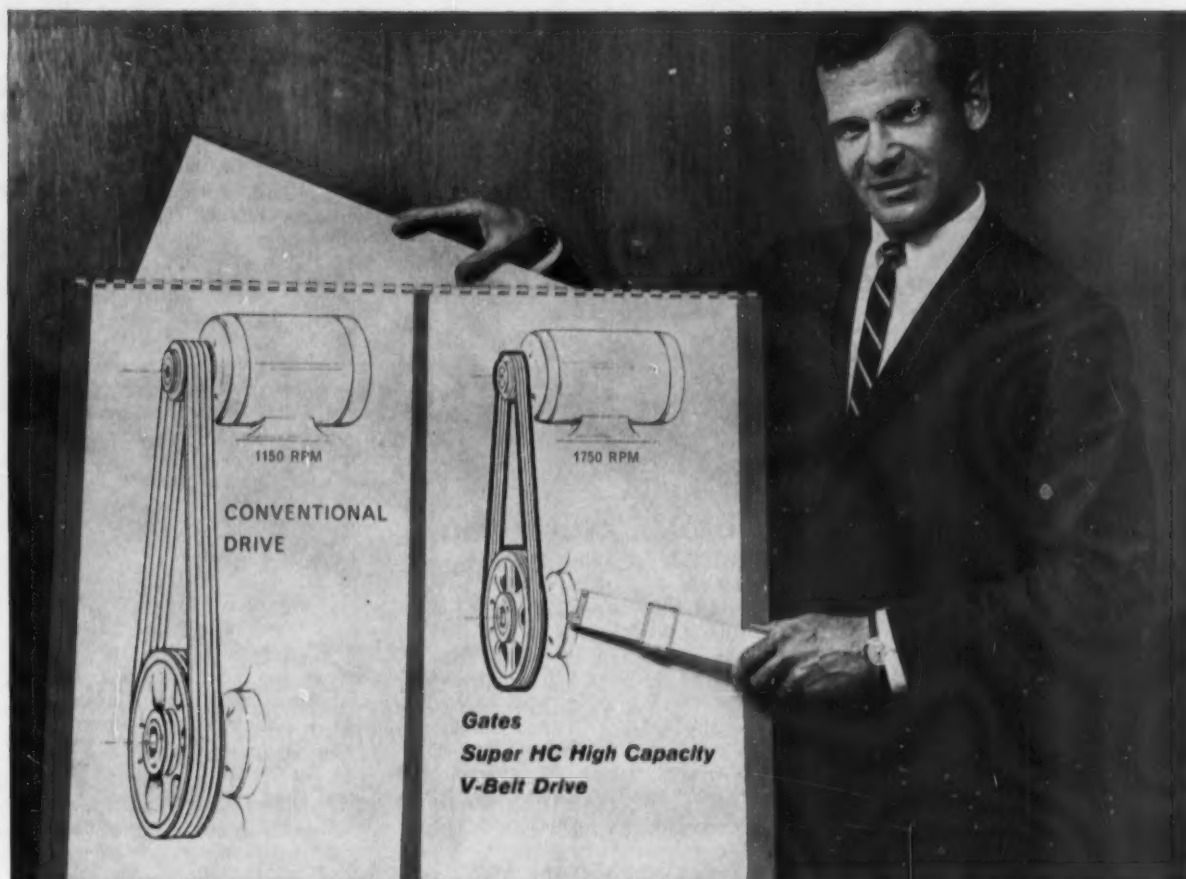
35. MITER GEARS—Globe Stock Gear

Div.—Gears include a keyway and set screw. These types and over 2000 other types and sizes listed in Catalog 58a.

36. MULTIPLE GROOVE DRIVES—

Browning Mfg. Co.—Reliable variable speed drives up to 125 hp, with 360 degree adjustment. Catalog MVP-101.

You may obtain any of these reference materials by circling the numbers on the reader service cards



How Gates Super HC Drives can save space, weight, money on the machines you design

Ask your local Gates Man to design a drive for your machine two ways: A conventional V-belt drive and a Gates Super HC High Capacity Drive. A quick comparison will show you that the new Gates Drive costs up to 20% less than a conventional V-belt drive, weighs about 20% less and can handle your power requirement in $\frac{2}{3}$ to $\frac{1}{2}$ the space.

These advantages are possible because of exclusive, basic changes in V-belt shape and construction that permit this drive to transmit up to 3 times the horsepower of a conventional V-belt drive in the same space.

Manufacturers everywhere have standardized on the Gates Super HC Drive—the first and most advanced High Capacity Drive. It is your best assurance that your power transmission unit will remain up-to-date for many years to come.

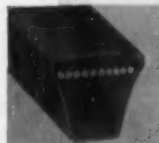
The Gates Man, located near you, has had long, intensive training and experience in drive design. *Contact him for complete technical data on Gates Super HC High Capacity Drives and for expert drive design aid.*

The Gates Rubber Company, Denver, Colorado

BPS4

Gates Super HC Drive Gives you these benefits:

- Saves up to 50% in drive space.
- Reduces drive weight 20% and more.
- Cuts drive costs as much as 20%.
- Reduces bearing load, increasing bearing life.
- Guards can be smaller, lighter weight.
- Belt speed up to 6000 ft/min possible without dynamic balancing.
- Less costly, higher speed motors can often be used.
- Jackshafts and outboard bearings can sometimes be eliminated.



Exclusive design features include: A Precisely Engineered Arched Top, Concave Sides, Flex-Weave Cover, super strength tensile construction.



Building the future on
50 years of progress

Gates Super HC V-Belt Drives

Circle 10 on Reader Service Card

PRODUCT NEWS

drive shafts. The high-speed shaft thrust-bearing and oil seals are enclosed in a self-contained housing. Design eliminates oil trapping, resulting in improved thermal ratings.

Forty-five sizes, standard ratios from 9.39:1 up to 211.0:1. Capacities to 1460 hp and torque capacities to 2,210,000 in.-lb. Foote Bros. Gear & Machine Corp., Chicago, Ill.

Circle 207 on Reader Service Card

Worm gear winch

Fully enclosed gear box can be filled with oil or grease.



Model 46602 develops a 1000-lb pull with a 20-lb pull on the handle. Gear ratio is 15:1; maximum capacity is 1500 lb. Weight 14½ lb.

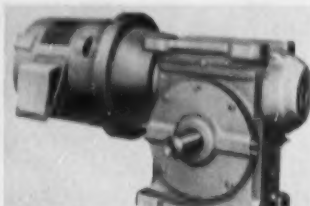
Gear case and one-piece drum

are cast iron. Main gear is machine-cut, heat-treated, ductile iron. All other parts are steel. Braking is positive—you must work the handle to move the load up or down. Thern Machine Co., Winona, Minn.,

Circle 208 on Reader Service Card

Right angle gearmotors

Single reduction gearing. For driving belts, chains, spur gearing and couplings.



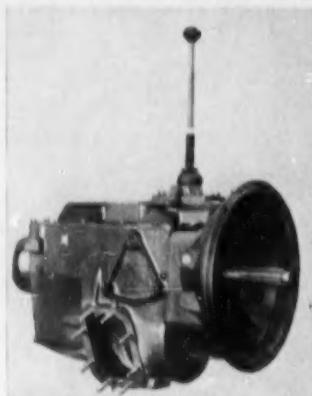
Both ac and dc integral types available. Ac motor types have NEMA frame sizes 182 (1 hp) to 286U (20 hp). Dc types have frame sizes 187A (1 hp) to 286A (15 hp). Involute helicoid thread-form worm gearing. Motors used are the Lifeline A and Lifeline H, round frame, with NEMA D standard flange. Westinghouse Electric Corp., Pittsburgh 30, Pa.

Circle 209 on Reader Service Card

Truck transmission

Features direct drive in 6th, with a low gear ratio of 8.23:1

Model 5662 Spicer transmission is nominally rated at 375-400 lb-ft torque. Ratios listed are: 2nd, 4.56:1; 3rd, 2.80:1; 4th 1.85:1; and 5th, 1.32:1. Top speeds are fully synchronized. All gears except



reverse are helical constant mesh. Cast iron case has SAE 6-bolt aperture on each side for side-mounted power take-offs. The case is adaptable to remote control shifting. Dana Corp., Toledo, Ohio.

Circle 210 on Reader Service Card

SIMPLIFY YOUR gear design PROBLEMS WITH - GLOBE'S NEW

"HMK" SERIES
MITER
GEARS



HMK miters are furnished with hardened teeth and include a keyway and set screw making them ready for immediate installation.

Over 2000 other types & sizes of gears listed in Catalog 58a

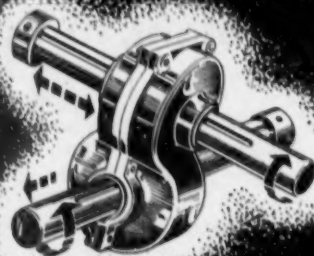
GLOBE STOCK GEAR DIV.

34th & Clearfield Sts., Phila. 32, Pa.

Circle 35 on Reader Service Card

THE MOST FLEXIBLE RIGHT ANGLE GEAR DRIVE DESIGNED

**FLOAT
-a-
SHAFT**
UNIVERSAL
RIGHT ANGLE
GEAR DRIVE
COUPLING



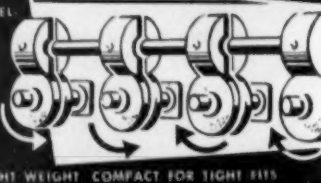
New, versatile gear drive designed to meet the needs of many applications requiring power transmission at right angles with a 1:1 ratio.

Easy to install, the floating feature of the unit permits self-alignment on the driving and driven shafts.

Ideal for operating packaging equipment, farm machinery, conveyors, rollers and all types of industrial equipment.

FEATURES

- FLOATS ON SHAFT FOR EXCEL-LENT ADAPTABILITY TO DIFFERENT MACHINES
- EASY TO INSTALL—NO COUPLINGS NEEDED
- SELF-ALIGNING
- HIGH HORSEPOWER AND TORQUE CAPACITY
- HARDENED HELICAL GEARS FOR RUGGED OPERATION
- ALUMINUM HOUSINGS—LIGHT WEIGHT—COMPACT FOR TIGHT FITS



Tol-O-Matic, Inc.

246 Tenth Avenue South • Minneapolis 15, Minn

Circle 27 on Reader Service Card

POWER TRANSMISSION DESIGN

LITERATURE

ON DRIVES AND COMPONENTS

Drives for fast stop/starts

Catalog No. 761 on the Vari-Power explains how this drive's use of a constantly spinning high-inertia rotor gives a flywheel effect when the brake is released. Output shaft comes to top speed almost instantly, and drive can take peak loads up to ten times rated capacity. *Ferguson Machine Co., St. Louis, Missouri.*

Circle 316 on Reader Service Card

Helical gear drives

Engineering catalog features simplified selection system plus complete description of various drive accessories. Shown for the first time is the new right angle drive series, in 45 sizes, double and triple reduction types. Also details on Type MRS drives, enclosed in fabricated steel housing. Gives the increased capacities for the entire helical drive line. *Foot Bros. Gear & Machine Corp., Chicago, Ill.*

Circle 317 on Reader Service Card

Remote controls for valves

Design manual 618 covers complete line of manual remote controls for use on ships and in chemical plants etc. Sections on flexible shafting, rigid-reach rod controls and gear boxes—including a 90 degree box and a new 300 degree swivel geared joint. Final section tells you how to select components for any valve up to 27-in. diameter handwheel. *Stow Mfg. Co., Binghamton, N. Y.*

Circle 318 on Reader Service Card

Compact V-belt drives

Bulletin A695A has 42 pages on narrow belt V-drives and sheaves. Includes Dyna-V drives in three basic sizes for fractional to 1500 hp. Data section with charts and nomographs, is useful for designing your own drives. *Dodge Mfg. Corp., Mishawaka, Ind.*

Circle 319 on Reader Service Card

LUBRICATION LITERATURE

Our editorial feature on page 19, tells about some of the latest developments in central lubrication systems. Much additional information on these, and on lubricants and lubrication generally, is available from manufacturers. Here are some of their bulletins. Use the Reader Service Card to get copies.

- 320 ALPHA-MOLYKOTE CORP.**—Molykote G is a grease-type lubricant compound containing molybdenum disulphide. Stops galling and seizing. Bulletin shows you how to apply it to heavy machine ways and guides, threaded connections and cams and other typical jobs. Bulletin 131.
- 321 BARDAHL MFG. CORP.**—Tells you how to choose the right lubricating grease and how to apply it properly. Includes a section on the effects of additives on grease. Grease Summary, 32 pages.
- 322 CHICAGO MFG. & DISTRIBUTING CO.**—CMD extreme-pressure lubricant withstands 20 tons per square inch without breakdown. Stops scoring in lathe centers, steady rests, thrust bearings, die set posts. Brochure.
- 323 ESSEX BRASS CORP.**—Catalog covers most types of oilers, pumps, lubricators, grease and oil cups, cylinder oilers, gauges, grease and oil guns, multiple oilers and sight feed units. Twenty-two pages.
- 324 FARVAL DIV., EATON MFG. CO.**—Booklet called "Modern Methods of Lubricant Application" explains basic principles and traces development of modern methods from the old oil and grease cups. Has sections on spray, mist, and circulating oil systems and a discussion on the use of electrical controls to time automatic systems.
- 325 FEDERAL BRASS MFG. CO.**—Type 550 flush mounting oil level gauges come in 3 sizes, with 4, 6 and 8-in long-sight openings. Details in flyer and data sheets.
- 326 HOHMAN PLATING AND MFG. INC.**—Surf-Kote A-1290 solid film lubricant is applied by spraying, dipping or brushing and air-dries in twenty minutes on most types of metallic surface. Bulletin SL-126.
- 327 KEYSTONE LUBRICATING CO.**—The RT Fitting with a flip-open cap replaces the hard-to-remove relief plug. Saves time in relube and helps prevent over-lube of ball and roller bearings on motors, pillow blocks, machines etc. Bulletin BU-61.
- 328 LINCOLN ENGINEERING CO.**—Catalog illustrates and describes semi- and fully automatic lubrication equipment as well as manual methods. Covers high and low pressure lubricant injectors, timing and alarm controls and filler pumps, plus accessories such as feed lines, coupling studs etc.
- 329 MCGLAUGHLIN OIL CO.**—Chain-Lube for chain rollers, bushings and bearings goes on like oil, hardens to consistency of grease. Water-proof, will not drip or fly off. Pamphlet gives details.
- 330 OIL RITE CORP.**—Catalog describes and illustrates electric oilers and spray systems. Also gives full selection data on oil cups, dispensers, valves and flow indicators, liquid level gages and filters and chain oilers. Catalog No. 10, 32 pages.
- 331 WHITMORE MFG. CO.**—Open chain lubricant is said to increase chain life up to 300 percent by reducing friction and stopping rust. Literature gives details.

COMING IN JANUARY

**POWER
TRANSMISSION
DESIGN**

PRODUCT SPECIFICATION ANNUAL

A "keep copy" issue of reference material valuable to designers and users of power transmission equipment.

Includes:

- more than 30 pages of detailed specification charts
- An engineering glossary of power transmission terms

Charts will show use, materials, sizes available and power and speed ratings for the following products:

Bearings
Gear Drives
Chain Drives
Belt Drives
Electric Motors
Clutches
Variable Speed Drives
Flexible Couplings

**Look For It
JANUARY, 1962**

MEN

OF THE POWER TRANSMISSION FIELD

Clark names automotive general sales manager

Roger W. Robinson will sales-manage Clark Equipment Co.'s Automotive Division, with responsibility for the Division's entire line. He has been with Clark since 1941, holding various sales jobs. His last post was manager of transmissions sales.



Robinson



Tarr

Tarr joins Board of Leeds & Northrup

Alfred E. Tarr, who in 1919 took a job as serviceman with Leeds & Northrup Co., was recently elected to the company's board of Directors.

In the interval, he was successively sales engineer, district manager, assistant director of marketing and assistant to the president. He is also active in the Instrument Society of America and served on its first Society Structure and Planning Committee.

Heads Dixon's new Washington office

E. A. Hitchcock will take charge of Dixon Corp's recently-opened Washington DC office. His job will be to coordinate the company's production more closely with government requirements for Rulon and Teflon components.

Named marketing manager for Dayco Corp.

Thomas E. Farrell succeeds J. A. Conlan as marketing manager for

the Rubber Products Division of Dayco Corp. Conlan was recently named vice president of the Division.

Farrell came to Dayco in 1952 as a district manager, was made Chicago regional manager in 1958.

New York Air Brake strengthens sales force

Latest managerial promotions in the Hydreco Division of New York Air Brake Co. are: Richard R. Mease, to manager of O.E.M. sales; and Charles B. Blackburn, to manager of parts and services, the position formerly held by Mease.

Burson elected Foote vice president

Robert G. Burson, director of marketing gear products and chain drive products for Foote Bros Gear and Machine Corp., was recently elected vice president. J. R. Fagan, president of Foote Bros, announced the appointment.



Burson



Hughes

Owatonna Tool appoints district manager

Otto L. Hughes is the new district manager for the Owatonna Tool Co. in Louisiana and northeastern Texas. His previous jobs include sales manager for a heavy machinery manufacturer and a period as sales representative for a truck equipment supplier.

JOB MARKET

POSITION WANTED

SALES MANAGEMENT

ENGINEERING

EXPERIENCE IN EXCESS

OF 20 YEARS

Executive seeks connection in New York/New Jersey area. Write: Box 12161, POWER TRANSMISSION DESIGN, 812 Huron Rd., Cleveland 15, Ohio.

Classified Advertising

Rates: Twenty dollars for the first inch and fifteen dollars for each additional inch or fraction.

Quality Clutches Exclusively



These **Over-Center Clutches** are General Purpose, heavy duty, friction clutches for machines requiring high quality dependable clutches with low power losses, low upkeep, and long life. Built in *Flex-Disc*, Solid Disc (two halves), and Gear Tooth types.

Five sets of over-center toggles provide two to three times greater bearing surface. Easily adjusted for wear by releasing latch and turning toggle assembly.

We offer a complete Clutch Engineering and Manufacturing Service — designing, producing, and applying clutches to meet any conditions arising in industry.

INDUSTRIAL CLUTCH CORP.

515 Frederick St. • Phone Liberty 7-3359 • Waukesha, Wis.

This company saved **\$195.42**
in v-belt maintenance stock
by switching to **VEELOS**

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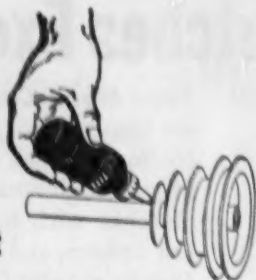
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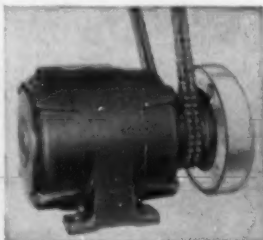
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